AVIATION

The Oldest American Aeronautical Magazine

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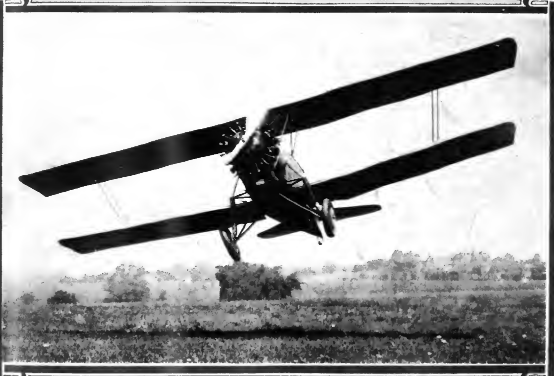

The new Pitcairn "Super-Mailwing" PA-6 climbing off the ground

VOLUME XXV

NUMBER 9

Special Features

The Travel Air 6000

The "Super-Mailwing"

Regarding the National Air Tour

AVIATION PUBLISHING CORPORATION
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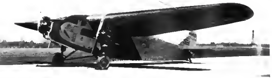

The Ford all-metal tri-motored transport monoplane

BECAUSE so many operators of flying organizations are contemplating transport work, either on an occasional or a regular schedule, there is naturally great interest in planes suited to that work

The Ford plane is built expressly for it To render dependable service, free from forced landings. To maintain schedules through the varying weather of the four seasons To furnish comfortable aerial transportation to passengers in its roomy, enclosed, heated cabin To provide economies in handling and operation To resist depreciation to an unsurpassed degree, and to permit the frequent and easy inspection careful operators insist on.

The purchase of a Ford plane, therefore, is an investment in uninterrupted flying service over a period of years. Its price, capabilities, and structural features should be viewed from that standpoint.

Any information you may desire on Ford planes may be obtained by communicating with us.

THE STOUT METAL AIRPLANE COMPANY
Division of FORD MOTOR COMPANY
Dearborn, Michigan

SPECIFICATIONS

Ford Tri-Motor Transport Model 4-AT

Dimensions		Performance		Data	
Span	74 ft	High speed	114 M P H	Weight empty	6,100 lbs
Length	49 ft 10 in	Cruising speed	95 M P H	Useful load	3,900 lbs
Wing area	785 sq. ft	Stalling speed	55 M P H	Total weight loaded	10 000 lbs
Height	12 ft 8 in	Radius of action (cruising)	570 miles (6 hrs)	Gasoline capacity	235 gal
Wheel tread	16 ft. 9 in.	Ceiling	14,000 ft	Wing load per sq ft.	12 74

Power Plant

The standard equipment power plant consists of three Wright 220 H P Whirlwind engines.

Optional at extra cost wing engines Wright Whirlwinds, center engine Pratt & Whitney 9-cylinder, radial 410 H P Wasp engine

Also optional extra cost, all three engines Pratt & Whitney 9 cylinder, radial 410 H P Wasp engines. Total H P 1230

For operation from landing fields in high altitudes a wing of slightly greater span is provided increasing the wing area fifty square feet

Propellers are Standard Steel Company's steel hub duralumin blade propellers

The entire plane is built of duralumin a non-rusting non corroding copper aluminum alloy as strong as steel but only one-third as heavy

Power load (lbs per H. P.)
2 engines - 22 7
3 engines - 15 1

Cabin capacity
Width - 4 ft 11 in
(average
Height - 5 ft 1 in
to 7 ft 8 in
Length - 15 ft 9 in

Passenger accommodation 350 cu ft

(Seats for ten removable baggage hold toilet etc.)

AVIATION

The Oldest American Aeronautical Magazine

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AVIATION

The Oldest American Aeronautical Magazine

Vol. XXV *AUGUST 25, 1928* **No. 9**

Catapulting Airplanes

CATAPULTING airplanes off of ocean liners has often been discussed but we have to thank the French Line for being the first to put the idea into actual practice. The Liore et Oliver flying boat, which was used, had a total weight loaded of some three tons, which shows that the French have progressed far in their catapulting work. Comdt. Louis Demougeot, the pilot of the plane, and his mechanic and radio man were launched with their plane when the Ile de France was more than 400 miles from shore. As there was a favoring wind, the plane made good time and the mail carried was delivered to the postoffice some 16 hours ahead of the time it would have been delivered had it made the complete crossing by steamer.

The achievement in itself is very worth while but there are considerably greater possibilities in store. The course of most trans-Atlantic liners skirts the Irish coast and comes within a few hundred miles of the coast of Newfoundland. The Irish coast is a day's sail from the French coast, and whatever is subtracted from this by the use of a plane is just so much extra time saved. Newfoundland is two days' sail from New York, but it is within easy flying distance. With flying fields or seaplane bases established in Newfoundland and on the Irish coast a saving of nearly a day and a half could be made on the west-east trip and a saving of nearly two days on the east-west trip.

The problem of flying from land to boat is much more difficult. Not only must the pilot of the plane find a very small spot in a very large ocean, but weather reporting is much more difficult at sea than on land, especially when there are local patches of fog existing. Then there is the problem of what the pilot would do when he got to the steamer. Under certain conditions the steamer could swing broadside to the wind and create a lee with smooth enough water so that the plane could land. However, this method would not always be practicable. Of course it would always be possible to drop the mail in water tight bags to be picked up by the steamer, or to have the mail bags caught by some sort of an attachment fitted to the steamer. Still, neither of these two methods would be entirely satisfactory, as it would mean that the plane that would have to return empty.

Some day these problems may be solved and when that time comes the mail will only travel by boat some seven or eight hundred miles of the eighteen hundred mile stretch between the coast of Newfoundland and the coast of Ireland. Thanks to the work done by our navy in the development of the catapult, and to the initiative of the French Line, a new field of possibilities has been opened to the aeronautical industry.

Plumbing Troubles

AS a continuation of Atlantic flight attempts seem to be inevitable, one might as well take advantage of the situation and draw such conclusion as may be derived from analyzing the causes for the failure of the flights. Courtney's flight, Francos' flight and the Polish flight were all three terminated by what is popularly known as "plumbing" trouble. In none of the instances cited was there any failure in the engines, but in all three cases the engines stopped through failure of the feed lines. The failure of Franco's four-engined Dornier plane was the most striking. Apparently all four engines quit at so nearly the same time that a hasty descent from a low altitude had to be made and the plane was very badly damaged. On investigation it was found that the gasolene pumping system had failed and apparently even the best of engines will not run without gasoline. It would seem as if this should have been realized before and that an independent pumping system should have been in operation for each engine. Working out a system where each engine is independent of the other, yet at the same time can use the gsaoline of any other engine is not as simple as it sounds, but it certainly can be worked out.

In the case of the Polish fliers the oil system failed, but as the plane was wrecked it may be hard to ascertain exactly what happened. Apparently the failure was not in the pumping system but in the piping system, as there was an evident and large leakage of oil. In the case of Captain Courtney the failure was due to the breaking of the main gasoline feed line. Evidently either the material used was faulty, or, what is more likely, it was so supported that it was subject to excessive strain and that failure was merely a question of time. In either case the danger of running gasoline lines through spaces enclosed by cowling and close to the exhaust was demonstrated.

The arrangement of feed lines is not an exact science and the stresses involved are not as calculable as those on a wing or crankshaft, but none the less, it would seem as if enough experience had been gathered to prevent so many failures from such causes. Of course, all the planes in question were in a sense experimental and the particular installation had not been tested in the tens of thousands of miles of flying which standard types run up. It is evident, however, that the arrangement of the feed lines, especially for the new types of engines which are being brought out, is a matter which requires the greatest care, and it should not be left to the shop mechanic or even to most plane designers. To the flier the failure of a feed line is just as serious as the failure of a crankshaft, and if engine manufacturers care about the reputation of their product they should check carefully with the plane manufacturer the details of the engine accessories.

Spot Welding *of* Aluminum *and* Its Alloys

BY W. M. DUNLAP
Metallurgist, Technical Direction Bureau, Aluminum Company of America

THE question of spot welding aluminum has been quite extensively studied in the laboratories of the Aluminum Company of America. Early in this study, it was necessary to determine what was to be considered a good weld, so as to establish a standard of comparison. It was found true, and our experience has been corroborated by the work of others on other metals, that the best spot weld is one which pulls out of the welded sheet so as to leave a hole as shown in Figs. 3 and 3A.

It was found that such welds could be made in 2S, the Aluminum company's designation for commercially pure aluminum, and in the alloys 3S, the designation of aluminum-manganese alloy; 17S, duralumin, 25S, aluminum-copper-manganese-silicon alloy, and 51S, which is the designation for aluminum-magnesium-silicon alloy. It was further found that this method of determining quality is reliable as a rough test.

Fig. 1 shows the simplest form of foot-operated spot welder. The die points are shown at A and the foot lever at B. A compression spring and adjusting nut for controlling the mechanical pressure applied to the work between the electrodes during the process of welding is shown at C. An automatic electric switch, not shown in this view, is opposite to D. The regulator switch for adjusting the secondary voltage and current is shown at E. The electrode horns are water cooled, the cooling ducts being connected by a rubber hose, shown at F.

Machines With Automatic Timers Best

On this type of machine the time of current application is regulated by the speed with which the foot treadle is depressed. Welding machines equipped with automatic timing devices are more satisfactory for spot welding aluminum.

An important difference between the spot welding of aluminum and steel is the readiness of copper to alloy with aluminum. When plain copper electrodes are used, the points are very soon coated with a layer of copper-aluminum alloy. When the electrode points become thus coated the quality of the welds is very poor and there is very great danger of burning a hole in the sheet, due to arcing. It is thus necessary to clean the copper electrode points with a file, or with emery cloth, quite frequently.

This, of course, means that the operator must spend a considerable part of his time cleaning electrodes. A recent development on which a patent has been applied for, consists in having chromium on the contact surfaces of the electrodes. The copper tips may be plated with chromium, or a piece of chromium rod may be inserted in the tip. With such tips, it is regular production experience to obtain from 1,800 to 2,300 spots on light gauge 2S and 3S sheet, without redressing and replating.

The size and shape of the electrode tip is important. The diameter of the contact surface should be between ¼ and ¾ in., the larger dimension being for thicker sheet. The contact surface of the electrode should be slightly rounded, as shown in Fig. 2. This requirement is particularly important when welding very thin sheet. The purpose of using a rounded welding tip is to produce a spot which is uniform in shape and quality. The

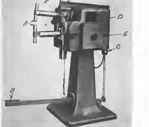
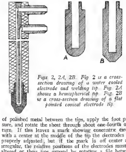


Fig. 1. Foot operated spot welder. Letter designations referred to in text matter.

rounded tips produce a dished spot in the sheet, but if the current density and mechanical pressure are correct, the depression is not deep enough to be objectionable. It has been claimed that electrodes with hemispherical tips, as shown in Fig. 2A, will automatically reduce the current density as the electrode sinks into the metal, and thus prevent excessive melting. This expedient seems of dubious merit and carries the disadvantage of producing a deeper indentation than desirable. However, it has been found that the welding of very thin gauge sheet measuring from 0.010 in. to 0.020 in. thick, which is very difficult with flat-tipped electrodes, can be readily performed with rounded tips.

When flat-pointed, conical tips, such as are shown in Fig. 2B, are used, it is very difficult to prevent eccentric

contact between the tips and the sheet, which causes a concentration of the current at one point and results in an uneven spot. Flat-pointed conical tips will give excellent results on stock 0.05 in. or greater in thickness, but the two contact surfaces of the electrodes must be absolutely parallel at the instant of contact when making the spot. A very satisfactory method of determining whether the electrodes are in perfect alignment is to place a piece



Figs. 2, 2A, 2B. Fig. 2 is a cross-section drawing of a water cooled electrode and welding tip. Fig. 2A shows a hemispherical tip. Fig. 2B is a cross-section drawing of a flat pointed conical electrode tip.

of polished metal between the tips, apply the foot pressure, and rotate the sheet through about one-fourth of a turn. If this leaves a mark showing concentric circles with a center at the middle of the tip the electrodes are properly adjusted, but if the mark is off center and irregular, the relative positions of the electrodes must be altered or their tips ground by rotating a file between them with the foot pressure on until the adjustment is correct. Of course, chromium plated tips must not be ground or filed.

Occasionally it is necessary to have the minimum indentation on one surface. This can be accomplished by using an electrode with a flat tip slightly largrr in diameter on that side of the joint. However, the spots made in this manner will usually not be as uniformly good as when both electrode tips are of equal size and slightly rounded. Due to the greater current density required with aluminum, the electrodes should be water-cooled and this water-cooling should be extended to within one-half inch of the contact surfaces of the tips.

As a result of the greater electrical conductivity of aluminum as compared to steel, higher current densities are necessary. Consequently, for spot welding aluminum, a machine of larger capacity must be employed than is required in the case of sheet steel of equal thickness. The principal variables requiring control are the mechanical pressure exerted by the electrodes upon the joint, the current density, and the time of current passage.

The general scheme to follow in setting up the machine for a certain job is to first reduce the mechanical pressure and current density to a point below that at which a spot will form and then to increase the current density. If "spitting" or arcing is observed, insufficient mechanical pressure is indicated. The lowest value for current density and mechanical pressure that will produce a good spot should always be used. A few trials consisting of pulling apart sample welds will ascertain the most suitable setting. A satisfactory weld in aluminum is one in which the spot will tear out of one sheet, rather than one in which the two pieces of sheet merely pull apart through the spot. Figs. 3 and 3A illustrate the failure of good spots.

No fixed values of current, pressure and time for spot welding different gauges of sheet of the various aluminum alloys can be given. By varying the time and pressure, it will be found that the limiting values for the current cover a wide range. Judicious adjustment of each of the three variables, time, current and pressure, will allow of making a satisfactory spot weld under circumstances which ordinarily seem most unfavorable. In working out the conditions for spot welding a particular thickness of metal, the best rule to follow is to employ as high a current and as low a pressure as is possible without dangrr of arcing. The values of the current across the electrodes and the mechanical pressure recorded are only approximate. They are merely intended to give some idea of the requirements for a particular gauge of sheet.

Metal	*Thickness of sheet*	*Amps in Secondary*	*Pressure in lbs*
2S	0.020 in.	4700	80
	0.030 in.	5900	80
	0.040 in.	6800	90
	0.050 in.	7600	90
	0.060 in.	8500	95
3S	0.020 in.	4800	80
	0.040 in.	6000	85
	0.060 in.	6800	95
	0.080 in.	7500	95
	0.100 in.	8100	100

Most metals are most easily welded when in the stage of plasticity lying between the molten and solid states, hence those metals which remain plastic the longest while cooling are the easiest to weld, and vice versa. In order to be welded, the metal must tend to flow at some critical temperature, so that it will cohere when pressure is applied. Aluminum is one of the few metals that does not become plastic until its melting temperatures are closely approached. Therefore welding conditions must be very closely controlled. Aluminum must be welded almost instantly in order to secure the desired kind of welded joint. The reason for this is that oxidation takes place if the heating is applied over any appreciable length of time.

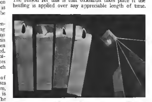


Fig. 3. Spot weld in 0.032 in. 2SO sheet, showing four sheets welded together in one operation, and the nature of the failure when the weld is torn apart.

By making aluminum welds practically instantaneous, the weld is consummated without time for oxidation. In fact, the quicker any kind of weld is made in any metal the better and stronger the weld is likely to be.

What has heretofore been written about spot welding is concerned mainly with the spot welding of steel. However, the spot welding of aluminum has been developed to a stage where it is used in regular production, particularly with pure aluminum and some of its alloys. Aluminum is easily welded and requires no special preparation. The main requirement for a satisfactory weld is that the metal must be clean and free from dirt, or heavy

(*Continued on page* 618)

The Travel Air 6000

New Type Designed for Mail, Express and Passenger Carrying Is Powered With a Wright "Whirlwind" Engine

PRODUCTION was started recently by the Travel Air Manufacturing Co, Wichita, Kan, on the new cabin monoplane, Type 6000. This plane has been designed for general commercial transport service including mail, express and passenger carrying. It is powered with a Wright "Whirlwind" J5-C engine developing 200 hp at 1800 r p m.

The plane is a six place, externally braced, high wing type and in design and construction conforms with general new production practice. It has a wing span of 48 ft 7 in., an overall length of 30 ft. 10½ in. and an overall height of 8 ft. 8½ in. The weight of the plane empty is 2375 lb and the gross weight loaded is 4000 lb. It has a pay load of 944 lb. Tests have shown a high speed of 128 m p h, a landing speed of 50 m p h, a climb of 700 ft. per min. at sea level and a service ceiling of 12,000 ft. The plane has taken off fully loaded with no wind in 720 ft and landed under the same conditions in 300 ft. by use of brakes.

As in other Travel Air models, Type 6000 has a welded steel tube fuselage and a wood wing structure. The wing is rectangular in platform and the airfoil section is the Gottingen 398. Box spars consisting of spruce caps with mahogany plywood webs are used and the ribs have spruce webs, capstrips, and trusses and plywood gussets. The ribs are attached by means of angle blocks glued and nailed and weigh 15 oz. each. All fittings are of heat treated chrome molybdenum steel.

Six bays are made in the internal drag bracing of the wing. The bay adjacent to the root and containing fuel tanks is braced by plywood at the top and bottom and all other bays are braced by double Macwhyte round swagged tie rods. Drag ribs are solid plywood webs with double spruce struts between the spars at top and bottom. From the leading edge to the front spar the wing is sheathed with duralumin. The trailing edge is formed of sheet duralumin and is very light and rigid. The wing tip is formed by a steel tube and two short ribs. The wing structure is linoiled and covered with Flightex Grade A fabric sewed through the full length of each rib.

A rear view of the Travel Air 6000.

Ailerons are of the frise type with wood structure and mounted with cast aluminum alloy hinges. Stabilizer and elevators are rectangular in shape and like fin and rudder are of steel tube construction. All control surfaces are fabric covered. The rudder is balanced but the elevators are not. The surfaces are actuated by extra flexible cable and aileron controls are completely inside the wing. The stabilizer is adjustable in flight. The wing is wired for landing and navigation lights and finished in Travel Air blue. Lift struts are steel tubes, amply faired with Balsa

(*Continued on page* 616)

Side view of the new Travel Air transport monoplane powered with a Wright "Whirlwind" engine

The "Super-Mailwing"

Improved Model of Pitcairn "Mailwing" Powered with a "Whirlwind." Has High Speed of 128 M. P. H. and Lands at 45 M. P. H.

THE latest and largest type of plane produced by Pitcairn Aviation, Inc, the "Super-Mailwing," has just been completed at the Company's factory, Bryn Athyn, Pa, and has performed successfully in flight tests conducted by James G. Ray, operations manager.

The Super-Mailwing is a modification of the Pitcairn Mailwing, which is now in use on eight airmail routes. It has the same wings, tail group and engine—Wright J-5-C—as the Mailwing, but has a fireproof mail compartment of nearly twice the capacity of the Mailwing, 40 cu ft instead of 21½ cu ft, making room for 500 lb of airmail of average bulk or 22,500 letters. This new and larger mail plane has been made necessary by the great increase in the volume of airmail carried throughout the country because of the reductions of postage rates to five cents for an ordinary letter weighing one ounce or less. Like the Mailwing, the new plane is designed primarily for mail and express, although on special jobs the mail compartment can be divided to make room for an open cockpit for two passengers, in addition to a quantity of mail.

By moving the pilot's cockpit back, reducing the space between the mail compartment and the engine and by making the fuselage slightly wider, the large increase in the capacity of the plane has been obtained with only twelve inches increase in the length of the fuselage. This change has, in fact, enabled an even better streamline form for the fuselage with the result that the performance and

Front view of the new "Super-Mailwing"

maneuverability of the Super-Mailwing have proved to be as great as those of the Mailwing, PA-5. The high speed of the plane with full night flying equipment, including two parachute flares, landing lights, storage battery, etc, is 128 m p h at 1950 r.p.m., while the cruising speed of the plane at 1700 r p m is 110 m p h. Landing speed is 45 m p h.

The many tried and proved features of construction and design of the Mailwing are retained in the new plane. For example, the longerons and principal cross members of the welded steel fuselage are of square section tubing in accordance with long established Pitcairn practice. This material is one inch square in section with round corners and has the great advantage of materially simplifying the welding processes and insuring better joints and greater all-round strength. No wires whatever are used in the fuselage structure, all bracing being by means of square or circular sheet tubing or tie rods welded into place. The fuselage is well paired over all sides with "U" section steel, a feature which contributes not only to performance but to pilot's visibility. It is also interesting to note that the cowling around the pilot's cockpit is rigidly supported on a metal structure such that it will withstand the heavy usage of pilots getting into and out of the cockpit.

(*Continued on page* 614)

A side view of the Pitcairn "Super-Mailwing," recently completed by Pitcairn Aviation, Inc.

Regarding *the* National Air Tour

BY JOHN T. NEVILL

WHAT did the 1928 National Air Tour prove in the way of airplane reliability and efficiency?

That question has been asked this writer, and the writer knows the same question has been asked a number of the pilots who flew in the Tour, as well as several others, who, like myself, were fortunate enough to accompany it.

One of the easiest ways to answer that question is to recite the facts as to what the Tour accomplished in a physical sense. That answer is simply this:

Approximately 1,500 hp., spread over 25 airplanes, transported approximately 70 men and women 6,600 mi. in approximately 70 hr. flying time.

Those are the facts. Could anything better demonstrate the reliability and efficiency of modern American aircraft? Of course, one could go further with his facts and point out that 24 of the 25 planes completed the trying route and returned to the starting point with their passengers; that the one plane forced out was compelled to do so because the pilot had difficulty obtaining parts for his Americanized foreign engine, the only one like it in the

John P. Wood and his "Whirlwind" powered Waco 10 with which he won the 1928 National Air Tour.

tour; that approximately one-third of the Tour route was over mountainous, thickly wooded country, where a safe landing might not easily be accomplished; that a considerable portion of it was across sun-baked desert country, where intense heat and "dead air" had to be overcome; that some of the mountainous portions necessitated an altitude of from 8,000 to 10,000 ft., allowing a reasonable margin of safety; that temperatures from those a little above the freezing point to that of 112 deg., experienced at Tucson, Ariz., were encountered during the 6,600 mi. flight; that there were but 15 forced landings, one of them being caused by shortage of fuel and most of the remainder by minor engine difficulties; that the 25 planes (including the one with the foreign engine that dropped out during the early stages of the Tour) flew 618 plane legs out of a possible total of 800 plane legs on scheduled time, or better; that the Tour crossed 17 states, visited 32 cities and towns in 15 of them, stopped two days in eight of the cities, overnight in 12 of them, and returned to Detroit, the starting point, in 29 days; that two of the planes were powered by 47 hp. engines, and one of those two was piloted by a woman; that but two of the 25 airplanes were damaged to any extent during the 6,600 mi.; and last, but not least (this is for the skeptics) that all of the pilots and passengers returned to the starting point in perfect health and well pleased with their adventure.

Of the 24 planes that completed the Tour only three received new engines at any stage over the route. Eddie Stinson, flying entry number 20, installed one in Tulsa, Okla.; Charlie Myers' plane, Waco number 19, got one in San Antonio, and Jack Atkinson's Monocoupe, number 29, received one after he had been forced down between Wausau and Milwaukee. Strictly speaking, none of the "new" engines installed were new. Both the "Whirlwinds" placed in entries numbers 19 and 20 had been used for approximately 100 hr. each, and the Velie engine going into Atkinson's plane had about 40 hr. against it.

Weather Conditions Generally Good

Weather conditions were, for the most part, favorable over the entire route. Except for four or five legs of headwind during the initial half of the Tour, and two or three legs of cross-winds and tailwinds, very little wind of any kind was encountered. Two or three very minor thunder and rain storms crossed the path of the touring planes during the 29 days of flying, none of them having even the slightest effect on the Tour schedule.

Now, in a series of thumb-nail reports, witness the performances of the individual planes.

Entry Number One was a Bellanca, model CH, monoplane piloted by William S. Brock, and carrying three possengers. It was powered by a Wright J5ca engine. Brock's figure of merit, or score for a perfectly flown leg, was 621.4. He flew 29 of the 32 legs on scheduled time, being delayed by headwinds over the legs between Ft. Worth and Waco and Waco and San Antonio. Like most of the competing pilots, Brock was late into Springfield, Mo., due, chiefly, to a miscalculation of the distance between that city and St. Louis. The distance was estimated at 184 mi. Brock's total score was 19,445.3 points, and he finished in eighth place.

Entry Number Two, a Ford tri-motored monoplane, flown by Capt. Frank M. Hawks and carrying six passen-

(*Continued on page* 611)

The Timm Biplane

Five Passenger, Cabin Biplane Designed to Seat Pilots in Open Cockpit Is Powered by a 260 Hp. Menasco-Salmson

THE Timm biplane recently completed by O. W. Timm Airplane Corp., Glendale, Calif., has been given a long series of load tests at the Oakland Airport. These tests are being made preliminary to an attempt to set a new world's endurance record. Otto Timm, the designer, feels that should this airplane be successful in surpassing the endurance records which have long been held by monoplanes he will have proved that the biplane has not yet been outclassed as a long range carrier.

Flown by Captain Roscoe Turner, who will make the endurance flight attempt, the Timm biplane took off with a load of 350 gal. of fuel after a run of 900 ft. and easily attained an altitude of 6200 ft. Powered with a Menasco-Salmson 260 hp. radial engine the high speed proved to be 112 m.p.h.

Designed for High Altitude Work

Originally designed to transport members of a Los Angeles hunting club to small high altitude landing fields in the Sierra Nevada Mountains, the Timm plane was designed with all calculations being based at 7000 ft. instead of sea level as is the custom. The cabin arrangement of the orginal design was unique in that it provided a semi-convertible enclosure, the rear upper half of the cabin fairing being demountable so that the passengers could change from a completely enclosed cabin to a large semi-open cockpit at will. The five passengers were seated in three wicker chairs fastened to the floor and in two seats built into the rear of the passenger compartment, and the two pilots placed in an open cockpit just forward of and above the cabin and provided with dual side by side control. The overall length of the fuselage is 31 ft. 9 in., the overall height in flying position is 11 ft. The span of both wings is 45 ft.

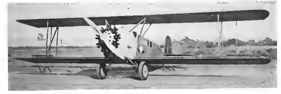
The 260 hp. nine cylinder radial Superposed Menasco-Salmson engine is mounted on a conventional steel tube detachable structure that is fastened to the fuselage with four bolts. The engine has been carefully cowled, the cowling being neatly streamlined into the fuselage which has a maximum depth of five feet and a maximum width of 44 in.

The fuselage is of chrome molybdenum steel tubing with welded joints and employs no wire bracing whatever. The forward part of the fuselage, from propeller spinner to just forward of the pilot's cockpit, is covered with the

Side view of the new Timm Biplane

aluminum cowling. The entire cabin is constructed of plywood, and the remainder of the fuselage is covered with fabric. The plywood covering is secured to the fuselage frame by specially routed spruce stringers that grip the tubing and to which the plywood is glued and nailed. It is said that this plywood construction eliminates the unpleasant drumming noises that are experienced when fabric is used alone. A large baggage compartment is located abaft the passenger cabin. Entrance and exit

(*Continued on page* 610)

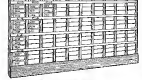


Front quarter view of the Timm Biplane powered with a 260 hp. Menasco-Salmson

Specifications *of the* Labor

By Edwin R. Douglas
Consulting Engineer

NOTWITHSTANDING all that has been said and done about standardized work, from the time of F. W. Taylor until now, it is still a subject little understood. "Time study," although but a part of it, is about the only part that has reached a popular ear. True, the painstaking study of "operation times" is a very important factor in cost reduction, but it is a long time job where many parts and operations are concerned. Of equal if not greater value is the planning, scheduling, and dispatching of production, and this may be successfully undertaken with but a fraction of the data required for a complete standardization of times. Later, the results of more careful time study may be incorporated in it. But



Reproduction of a drawing of the control board described in this article

the two things are separate elements, and it is a mistake to wait for complete time studies before starting to plan and schedule production.

Production planning requires a knowledge of what, how, and where work is to be done, but only approximately of how long it will take. Its great savings are made through the prevention of interferences, break ups, and delays, and through getting parts and products out when needed and when promised. The starting point of this is the labor specification. For reference, the form of specification shown in the preceding article is repeated in this article.

In the lower half of this sheet are listed all the operations that have to be performed on the several items of material which have been given on the upper half, or on their assembly into the complete part. For each, the drawing no., operation, tools, and brief description are given, as well as the number of men working, number of pieces, and an (approximate) estimate of the time required. In the case of the material, the foreman had to deal with only one man—the storekeeper—and one list was sufficient for it all. But in the case of labor, the foreman has to deal with each crew of men separately, and each requires its individual instructions. Moreover, while all the material might be taken out in one lot, the labor may be extended over a period of several days, or even weeks. And the work of each crew and the time of each member of it must be reported separately each week, if not every day. Finally, as will be seen, there is the requirement of means for scheduling and dispatching the work. All these things combine to call for separate labor tickets for each operation and each man, indicating what is to be done, by whom it is to be done, how much time is consumed, and what wage is to be paid for it.

The forms of labor-tickets and the ways of recording labor time are multitudinous. It is not proposed to go into lengthy discussion of them. The few samples that are to be given are more to illustrate the principles than to recommend the particular forms.

A Minimum of Clerical Work

In any system for reporting labor the clerical work by foremen and workmen should be made a minimum. They should not be called on to write out labor tickets complete, or indeed to do more than record their time and production. Even these duties may often be placed elsewhere with advantage. It is good practice to use time clocks to stamp the starting and stopping times, as it reduces errors. It is good practice to record these times in hours and decimals rather than in hours and minutes, as it saves clerks' time in wage figuring. It is good practice to have the times entered by a timekeeper and the productions by a weigher or inspector, as it secures accuracy and reduces clerical work by shopmen. But these are not the most important things. Given the labor-specifications as shown, the most important thing is that the labor tickets should be typed or written in advance and copied, item for item, from those specifications on forms that provide spaces also for the workmen's numbers, starting and stopping times, productions, and wage extensions. When these are written in advance, with the approximate time requirements of each indicated, they become the means of controlling the production with an accuracy to a certain extent that is otherwise utterly impossible. This control is maintained under the direction of the foreman, superintendent, by a supervisor of production, or by a competent

clerk, through the use of a control-board or equivalent means.

This board consists of a series of pockets, each of a size to hold a bunch of labor tickets with the ends projecting. These pockets are arranged in groups of three, each group corresponding to one machine or work place. For use with such a board, the labor tickets are made out in advance—copied from the specification—in two copies (original and duplicate) joined, but perforated to tear apart. Preferably they are typewritten. When a production order is issued, the specifications, drawings, instruction sheets, and a set of these labor tickets covering the work to be done, are sent from the Production Department to the control board clerk of each department involved. The specifications act also as production orders; these the clerk files for the foreman's later reference. The drawings and instructions he files for delivery to the workman when work is to be started. The labor tickets he arranges in the control board pockets, as follows:

In each group of three pockets, the upper one will contain a single ticket (the carbon copy) showing what operation is now in work on the machine in question. The original of this will have been given to the workman. The next lower pocket will contain a selected group of tickets (originals and duplicates together) representing those jobs which are scheduled to be run on that machine during the balance of the day. While the bottom pocket will contain all the other tickets which have been made out for that machine but which are not to be run till the next day or later. The tickets in the bottom pocket may well be arranged in order as they should be run, subject to rearrangement if conditions change. In this board, arranged in this way by machines, etc., are tickets for all the work ahead of that department.

When a workman finishes a job he reports to the control

(*Continued on page 608*)

PRODUCTION ORDER TO MR DEPT PRODUCTION ORDER No.

K. R. & CO. FORM

SPECIFICATION OF
FUSELAGE MEMBERS
SIDE BOTH REAR SUB-ASSEMBLY
DR END

SHEET OF
QUANTITY USED ON: NO E 2

DATE
BY
APPD
SPECIFICATION NO. C2 F 42
OF DATE June 7, 1928

COVERS MATERIAL AND LABOR FOR 20 PARTS ON WHICH SCHED. USED TIME IS 30 hrs. SUPERSEDES SPEC. OF DATE

SPECIFICATION—COSTS

DATE DATE MATERIAL REC. BY COMPLETED

SYM	STORES CLASS AND NO	CUT	DESCRIPTION	NO OF PIECES PER PART	NO OF PIECES TOTAL	TOTAL QUANT. TO ISSUE	PRICE	VALUE	BURDEN
	MATERIAL								
a	1031 S2 675	31	#102 Upper Center Long-	1	20	52'			
b	" " 655	57	#103 " Rear (eron	1	20	95' 3"			
c	" " 675	34	#105 Lower Center "	1	20	56' 11"			
d	" " 655	116 ½	#106 " Rear "	1	20	194' 5"			
e	" " 615	23 ½	#111 Vertical Sta. 5	1	20	39'			
f	" " 615	15 ½	#112 " " 6	1	20	32' 9"			
g	" " 635	16	#113 " " 7	1	20	26' 11"			
h	" " 635	39	#134 Diagonal Sta. 4	1	20	65' 3"			
i	" " 635	37 ½	#135 " " 5	1	20	62' 9"			
k	" " 635	33	#136 " " 6	1	20	55' 3"			
l	" " 615	26	#137 " " 7	1	20	43' 7"			
m	" " 615	15	#156 " " 9-8	1	20	25' 3"			
p	1015 S10		Welding Rod						

SYM	SEE DRAWING	CLASS OF OPERATION	TOOLS	INSTRUCTIONS	STD. PROD.	NO. OF PIECES REQD.	TOTAL TIME EXPECTED	DEPT	DATE	WAGES	BURDEN
a-1 b-1 p-1	LABOR 802 F	Cut	Hack Saw	See Cutting Chart							
a-2 b-2 p-2	"	Clamp in Jig	Screw Driver	Clamp Tight in Jig							
d-1 1	"	Cut	Hack Saw	See Cutting Chart	.47 .47	20 sets	9.4 9.4	F 4			
d-1 2	"	Fit	File Vise Jigs	Cut & Fit Tubeing at Proper Stations							
q-1	"	Tack	Torch Jig	Tack A to 1 to a,b,&c	.13 .13 .13	20	2.6 2.6 2.6	F 4			
q-2	"	Remove from Jig	Screw Driver		.04 .04	20	.8 .8	F 4			
q-3	"	Weld	Torch	Around end of Tubeing	.83	20	16.6	F 4			
				TOTAL TIME			44.8				

HEADINGS FOR LABOR OPERATIONS ABOVE

Preparations for Coast Air Meet are Nearly Completed

Pilots from All Parts of U.S. and Neighboring Countries to Compete for Awards

LOS ANGELES, CALIF—With the 1928 National Air Races and Aeronautical Exposition opening in Los Angeles, September 8, aviators in all parts of the United States and neighboring countries are ready to contest for the $200,000 in prizes and valuable trophy awards posted for the event by the California Air Race Association, sponsor of the meet Inventors and manufacturers in this country and abroad have prepared exhibits of new models of planes, never before shown, airport equipment and every form of aviation apparatus to be displayed in connection with the big meet Thirty new types of planes and many new engines will be exhibited.

Mines Field has been transformed into the most elaborate aerial park in the country. The mammoth exposition hall is completed, and will be the counterpiece of the array of buildings of Spanish design to house the exhibits and provide accommodations for the thousands of visiting aviators, exhibitors and others. Three runways, each 7,000 ft long, have been surfaced for the meet One is to be used exclusively for contest fliers to take off, one for landing and the third for arriving and visiting planes A large grandstand of unique design has been completed The program will open daily at 10 o'clock, A.M and concluding at 10 o'clock, P.M.

Dudley M Steele, Contest Chairman

Preparing for Thousands

The California Air Race Association is preparing to accommodate hundreds of planes and some 4,000 pilots and their assistants The executive committee, including President Theodore T. Hull, chairman, Harry Wetzell, Dr T C Young Dudley M Steele, contest chairman, W L Stewart, Jr, J F Jeffries, Robert J. Pritchard, and D E. MacDonald, has been in charge of all arrangements

The Transcontinental Air Race New York to Los Angeles is for civilian planes only, with $40,000 and valuable trophies posted The entrants are divided into three classes with respect to engine rating and the race will be conducted through 17 control cities across the continent, the awards being made on elapsed time. For the Transcontinental Non Stop Air Races from New York to Los Angeles $22 500 and valuable trophies are posted This is to be a free-for-all event, the winner to receive $12 500 second place, $6 000, third $3,000, and fourth, $1,000

Special Canadian Race

Pilots who are citizens of Canada only are eligible to enter the International Race from Windsor, Canada, to Los Angeles, and compete for the $10,000 in prizes posted. The race is limited to planes with engines of 800 cu. in. displacement or less The Pan American Air Derby from Mexico City to Los Angeles is for $10 000 in prizes and is limited to citizens of Latin-American countries It is open to any size plane using any type engine

The Class A California Air Race, San Francisco to Los Angeles, is open to planes of any type powered with engines of 510 cu in displacement or less The awards include $2,000 in prizes and trophies The Class B California Air Race, Oakland to Los Angeles is for $3 000 and trophies and is open to planes of more than 510 cu displacement and less than 800

To Make Duration Attempts

Included in the closed course races and special events will be contests to break the world's airline distance record and the world's endurance record. For boys and girls there will be an airplane model building contest and an airplane model flying contest with valuable prizes awarded.

An unique contest will be the civilian relay race, with four teams of five ships each to compete Four special civilian free-for-all races have been arranged.

Civilians only will compete for the Aviation Town and Country Club of Detroit Trophy in addition to $4,000 in prizes, a free-for-all speed and efficiency event. Cabin-type planes piloted by civilians and carrying a minimum load of 1,000 lb at a minimum speed of 800 m p h will compete for the Detroit News Air Transport Trophy and $3000 in prizes in addition.

In addition to Army and Navy parachute contests and pursuit plane races, a special National Guard event, open to planes in service of states in all parts of the country, will be staged. Another special event expected to create great interest is the light airplane speed and efficiency contest, open to all type ships of 300 cu in engine displacement or less, piloted by civilians for which $3,000 and valuable trophies is posted.

Officials of the association have mailed invitations for the first annual convention of airport managers, in the hope of forming an organization to standardize airport equipment Among other conventions to be staged during the air meet are the National Association of Air Mail Pilots' assembly, the Professional Pilots' Association annual meeting, and Society of Automotive Engineers convention.

Kincade Goes To Lycoming

WILLIAMSPORT, PA.—T. H "Doc" Kinkade, recognized as a leading air cooled engine expert, has become affiliated with the Lycoming Manufacturing Co and will assume duties at once, it is announced here at headquarters of that engine manufacturing company

Kankade's record with air-cooled engines was first heard of nationally through his work as engine instructor on aircraft power plants in the Army and Navy training stations. During the past year, Kinkade has become well-known through his tuning of various Whirlwind engines used in trans-oceanic flights The engines of the Bellanca Columbia, Commander Byrd's Fokker, and Ruth Elder and George Haldeman's Stinson plane were among those Kinkade serviced

Stinson Plane Entered In Race by Syracuse

SYRACUSE, N Y—Syracuse will be represented in the New York to Los Angeles non-stop air race September 12, with the General Aviation Co., Inc., of this city, entering its Stinson-Detroiter cabin monoplane in the event.

Clifford E McMillin, chief pilot for the General company, and Fred McGlynn formerly of Mitchel Field and now piloting a Stinson Junior monoplane for Byron M Mitchell Syracuse investment banker, will fly the Syracuse plane. Both are transport pilots.

The Syracuse Stinson, named the "Miss Onondaga," will be flown to the Stinson factory in Northville, Mich., August 31 Necessary changes in the plane will be made there.

City to Develop Boston Airport

Council Approves $125,000 Appropriation to Place Field Under Municipal Control

Special Wire to Aviation

BOSTON, MASS—An initial appropriation of $125,000 has been approved by the City Council to place the development of the Boston Airport under city control and Mayor Malcolm E Nichols is awaiting the decision of the War Department on his request that Lieut Donald Duke present commander of Boston Airport, be given a leave of absence to supervise the work This was made public recently following the meeting of the city council

The program calls for enclosing of the airport area with 8 ft. steel fence, installation of a complete drainage system and removal of the present hangar to the East Boston edge of the field. A boulevard approach and a seaplane runway and float also are to be provided.

While the city will not erect buildings on the field it is hoped that the memorial control tower, which the American Legion is now promoting, will be built Several applications already have been submitted by private companies for hangar space.

Plans have been made by the Army to raze the present steel iron hangars and replace them with new ones. It is expected that the hangar of the Boston Airport Corp. which is the only brick and wood commercial hangar on the field, also will be razed

The improvement program is expected to be underway by October

Air Derby Committees Are Announced by Day

NEW YORK N Y—Stephen A. Day chairman of the Contest of the New York-Los Angeles Air Derby has announced the committees that will assist him in getting the pilots off in the three divisions of the races to start from New York September 4, 5, and 10 Members of the Contest Committee with Mr. Day are Henry Boston, William A Rogers and D L. Ord George W Townsend, president of the Moto Meter Co will be chief starter assisted by Frank Tallman, John J. White, and L T. Salomon

Carl Schory will be official timer, assisted by Allen J Cameron, and R Sidney Bowen, editor of Aviation The task of assigning numbers to the contestants will be assumed by a committee composed of Hugh O'Reilley as chairman: Hubert Huntington and George Post. Harry Booth, as ground engineer will be assisted by Jerry Catalin.

Richard R Blythe has been appointed chairman of the publicity committee and H B Clark will be in charge of field operations.

Approve Nine More Aircraft

WASHINGTON, D C.—Seven more planes have been granted approved type certificates, according to an announcement here. This brings the certificate numbers to 61

The newly approved craft are: 55 Stearman C-3B, three place open cockpit, biplane, Whirlwind, 56. Fokker F-10, 14 place cabin monoplane, three Wasps, 57 Eaglerock A-1, three place open biplane, Whirlwind, 58 Eaglerock A-2, three place open biplane, OX-5, OXX-6, 59 Eaglerock A-3 and A-4, three place open biplane, Hisso A or I-150, E-180, 60 Sikorsky S-38-A, 11 place cabin amphibian biplane, two Wasps, 61 Fairchild FC2W2 five place cabin monoplane convertible land or seaplane, Wasp, 62 Stearman C 36C, three place open biplane, Hisso 150-180 hp., 63 Curtiss plane, 170 hp. "Challenger" engine.

Goodyear-Zeppelin Co. Dirigible Christened

AKRON, O.—The newest Goodyear dirigible balloon "Puritan" was formally christened and flown for the first time recently in Akron The new balloon is 128 ft. long, 37 ft. in diameter, has a helium capacity of 86 000 cu ft and a cruising radius of 550 mi. with two passengers and a pilot It is powered with two radial air cooled engines giving it a maximum speed of 55 m p h and a cruising speed of 46 m p h.

The Puritan is the first dirigible to be constructed by the Goodyear-Zeppelin Corp, which was organized three years ago Dr Karl Arnstein formerly chief engineer of the German Zeppelin Co and now vice president in charge of engineering for the Goodyear-Zeppelin Corp, was in charge of the design and development

Hassell Believed Lost in the North

Search Being Made for Stimson Plane Long Overdue at Greenland

NEW YORK, N Y—Canada, Newfoundland, Greenland and Denmark are aiding the United States Government in the search for Bert Hassell and Parker Cramer in the Whirlwind powered Stinson Detroiter "Greater Rockford," which is believed to be lost on the second stage of its attempted flight from Rockford, Ill., to Sweden. As we go to press radiograms have been received stating that the fliers are more than two days overdue at Mount Evans, Greenland where they were scheduled to arrive August 19

The Greater Rockford, piloted by Hassell, took off from Rockford, Ill, on the morning of August 16 and arrived without incident at Cochrane, Ontario, making the 800 mi. run in approximately 7 hr. After refueling and waiting for favorable weather the fliers took off from Cochrane on the 1,006 mi. stage of the journey early in the afternoon of August 18 and were last heard from in a radiogram sent on the morning of August 19, giving the position of the plane as a point 75 mi off Cape Chidley, Labrador The fliers planned to reach Reykjavik on the third leg of the flight and Stockholm on the last.

Coast Guard Cutter Aids

The U. S Coast Guard cutter *Marion*, which was near the projected path of the flight, has been instructed to search for the plane and Canadian trappers, mounted police and airplanes are scouring the uninhabited country adjacent to the Labrador coast. At Mount Evans a vigil was kept for hours after hope of the fliers' arrival was abandoned

Among the watchers was Prof W. H. Hobbs, head of the University of Michigan Expedition, who stated that if the fliers were forced down in the inaccessible region between Mount Evans and the Greenland Coast there was a possibility of their being found.

Whirlwind powered Stinson Detroiter piloted by Bert Hassell who with Parker Cramer is believed to be lost in flight to Sweden

Chicago to Have Big Aero Show

Coliseum Leased by Aeronautical Chamber of Commerce for International Event

CHICAGO, ILL. — The Aeronautical Chamber of Commerce of America, through the Aeronautical Expositions Corp., has leased the Coliseum and Annexes in Chicago for an International Aircraft Exposition, December 1 to 9, inclusive.

The Chicago show will be the first International Aircraft Exposition to be held in the United States since a year following the World War. The date of the Chicago show was set after the Chamber had been apprised of the desire of President Coolidge that the American aircraft industry hold an exposition prior to the International Conference on civil aeronautics, which he has called to be held in Washington, December 12, 13, and 14.

Col. Paul Henderson, vice president of the Great Lakes Division of the Chamber, gave a luncheon to the Chicago Aero Commission at the Union League Club on August 7 at which time preliminary plans for the show were outlined by Luther K. Bell and John Harding, Jr. From reports already received by the Chamber, it appears certain that the forthcoming Chicago show will attract exhibits in such number as to tax the capacity of the Coliseum and adjoining halls.

Will Have Two Phases

The Chicago Exposition will have two distinct phases. One has to do with commercial aviation and the other with international aeronautical relations. It is estimated that between 25 and 35 representatives of foreign powers accredited to the Washington Conference, will desire to visit the Chicago show. At the meeting of the Aero Commission a committee was appointed to consider ways and means for the entertainment of these distinguished visitors. The committee, as announced by Colonel Henderson, includes the following: Elmer T. Stevens, president, Charles A. Stevens & Bros.; George B. Foster, Chairman of the Aviation Committee of the Chicago Association of Commerce; James Simpson, president Marshall Field & Co.; George Getz, capitalist; Earle H. Reynolds, president, National Air Transport, Inc.; Maj. Reed G. Landis, secretary of the Aero Commission.

Scott in 15,000 Ft. Jump

WASHINGTON, D. C.—A new Navy record was recently established when Chief Machinists Mate William F. Scott of the Navy air service made a parachute jump of 15,000 ft. here. Scott will next attempt a 20,000 ft. jump. He eventually hopes to break record of 24,000 ft.

Buys Hundredth

Clayton J. Bruhner, president of the Advance Aircraft Co., congratulating John Livingston, president of the Midwest Airways Corp., of Monmouth, Ill., on the occasion of his taking delivery of his hundredth Waco Airplane.

Barber & Baldwin, Inc. Provides Race Awards

NEW YORK, N. Y.—A trophy and purse of $250 will be awarded at the termination of the National Air Races and Aeronautical Exposition to be held in Los Angeles, to the participating pilot who, in the opinion of the governing committee, accomplishes the most meritorious performance. This award was offered by Barber & Baldwin, Inc., New York aviation underwriters, in the interest of safe flying and has been accepted by the governing committee.

This purse and trophy were offered in a telegram from Barber & Baldwin, Inc., in which it was explained that the word meritorious was to be interpreted in terms of accomplishment under ordinary flying conditions. Thus it eliminates the pilot whose performance is accomplished as a result of excessive or unreasonable risk and the pilot whose accomplishment is achieved under conditions of unreasonably excessive caution.

Springfield Company Expands

SPRINGFIELD, MASS.—Northeastern Aircraft Corp. has recently been announced in this city as an expansion of what was formerly known as the Springfield Airlines Corp. Capt. Louis E. Hasbrouck has joined the organization as treasurer and business manager and improvement plans at the Dunn field, Longmeadow, headquarters of the company are to be carried out in the near future. The Flying Club of Springfield has been operating in corporation with the Dunn field organization since its formation a year ago. It is now operating a Travel Air three-place biplane.

Curtiss to Show Engine Progress

To Depict 20 Yr. of Aircraft Power Plant Development at Coast Exhibit

GARDEN CITY, N. Y.—Among the features at the coming Los Angeles Aeronautical Exposition September 8-16 will be the exhibit of the Curtiss Aeroplane and Motor Co. of this city representing 20 yr. of progress in aircraft engine design.

One of the features will be the famous old Curtiss motorcycle with which Glenn Curtiss, in 1907, traveled a mile at the record-breaking speed of 137 m.p.h. The motorcycle was powered with an eight-cylinder air-cooled Vee type Curtiss engine, the first of its kind in the country, and which was immediately adopted for aeronautical use. Contrasted with this will be a complete line of modern Curtiss aircraft engines of both air and water-cooled types ranging from 170 to 600 hp.

Of primary interest to the commercial manufacturer is the new Curtiss "Challenger" which makes its debut at the Los Angeles show. The Challenger is an air-cooled radial engine of unique design, having six cylinders, staggered in arrangement, on a two-throw crankshaft. It is rated at 170 hp. at 1800 r.p.m., and has been produced especially to meet the widespread demand for a medium-powered engine. A technical description of this power plant will be contained in an early issue of AVIATION.

To Exhibit "Chieftan"

Another Curtiss engine which will be shown for the first time at Los Angeles is the powerful "Chieftain," recently developed. The Chieftain, which develops 600 hp. at 2200 r.p.m., has 12 cylinders arranged in two hexagonal rows of six, producing a lower frontal area per horsepower than is possible with the single-row radial type.

The well-known Curtiss water-cooled types of engines will be represented by the famous D-12 and "Conqueror" models. The D-12 is standard equipment of the Air Corps on high-performance pursuit and observation types which will be seen in action in the military racing events, and the Conqueror is a 625 hp. development from the D-12 basic design, which is now being produced in quantities for military and commercial use.

In addition to the above, Curtiss will display the Curtiss-Reed duralumin propellers.

Company Increases Capital

OKLAHOMA CITY, OKLA.—The Air Service Corp. has increased its capital stock from $5,000 to $30,000 with the taking over of the agency for the Monocoupe here.

Tests Are Made On Two Engines

Kimball Aircraft Corp. of Naugatuck, Conn., Will Soon Start Production

NAUGATUCK, CONN. — Two new types of air-cooled engines have been developed by the recently organized Kimball Aircraft Corp., of Naugatuck, Conn., and the first models are now being tested at the factory. The engines were designed by L. B. Kimball, president of the firm, and Augustus Hasbrouck, chief engineer. The company plans to go into production as soon as all tests are completed.

The two engines are designated "Gnat" Model M and "Beetle" Model K by the manufacturers. The "Gnat" is a two-cylinder opposed type with a rating of 25 hp. at 2500 r.p.m., while the "Beetle" is a seven-cylinder radial type developing a rated horsepower of 135 at 1800 r.p.m.

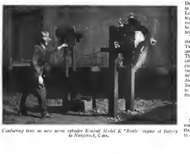
"Gnat" Engine is Light

The "Gnat" weighs only 100 lb. and has been designed for use in a light plane which the company intends to build at some future time and to satisfy the demand of clubs for a small sport plane engine.

Several distinctive features are noted in the "Beetle." An outstanding departure from conventional practice is found in the cylinder heads, which are of the "L" type, each having its exhaust valve placed on the top for cooling purposes, and the intake valve underneath. The valve push rods and all accessories are located at the rear of the engine, leaving the front perfectly clean. Provision has been made to equip the engine with both starter and generator. The total weight of the power plant is 400 lb. Three of these engines have been built and, after undergoing tests at the factory, one will be sent to Washington for Department of Commerce tests. The price of this power plant is expected to be about $2,500.

Two cylinder Kimball Model M "Gnat" opposed engine on test stand

The company now occupies an entire floor of the building in which the factory is located and employs about 30 persons. This force will be augmented as soon as production is actually started.



Conducting tests on new seven cylinder Kimball Model K "Beetle" engine at factory in Naugatuck, Conn.

King to Washington Post

WASHINGTON, D. C.—Orders have been issued here detaching Capt. Ernest J. King, from command of the Aircraft Squadron, scouting fleet, and directing him to report at the Navy Department for duty as Assistant Chief of the Bureau of Aeronautics. He has relieved Capt. Emory S. Land, Construction Corps, who has been granted leave of absence for one year in order that he may serve as technical adviser with the Guggenheim Foundation for Promotion of Aeronautics.

Data on French Line's Seaplane and Catapult

NEW YORK, N. Y.—Additional information concerning the Liore et Olivier flying boat and the catapult used in launching it from the *Ile de France* is contained in a statement issued by the French Line here following its successful inauguration of ship-to-shore service on Monday, August 13. At that time the plane was sent into the air when the liner was more than 400 mi. from Quarantine. Carrying three sacks of mail, Comdr. Louis Demongeot flew to New York, arriving 16 hr. before the ship.

In addition to the description of plane and catapult published in the July 28 issue of AVIATION, it is to be stated that the wheels making the plane an amphibian were removed to be replaced in the event direct service to a landing field is begun. The plane, weighing 7,275 lb. is credited with a maximum speed of 105 m.p.h. and a flying range of seven hours at the cruising rate of 90 m.p.h. A 420 hp. Gnome-Rhone-Jupiter radial air cooled engine powers the craft, which in tests has reached an altitude of better than 13,000 ft.

Catapult Weights 60 Tons

The catapult, it is stated, was built by the Penhoet Shipyards at St. Nazaire, the only company building catapults in France and these for the French Navy. The length of the catapult is 111 ft. 7 in., with the runway itself 88 ft. 7 in. in length; its weight is 60 tons. Run by compressed air, the device is said to be capable of tossing four tons into the air at 112 m.p.h.

Many Wichita Planes Entered in Air Derby

WICHITA, KAN.—Wichita airplane manufacturers will be represented by at least a dozen planes in the National Air Derby, New York to Los Angeles, early in September. While Dudley Steele of Los Angeles, one of the managers of the transcontinental races, was in Wichita completing arrangements for the derby, he called on manufacturers and got a tentative list of the entrants.

The Cessna Aircraft Co. plans to have three cantilever monoplanes in the races. Two will be equipped with Wright engines and one will be powered with a Warner. The Laird company plans to enter two cabin biplanes powered with Wright engines. The Swift company will have a two-place biplane in the races. It is anticipated a half dozen dealers for Travel Air, Inc., will be represented and the Swallow and Stearman companies are said to be working on special racing planes for the derby.

Aero Advertising to Gould

NEW YORK, N. Y.—Canadian Colonial Airways Inc., of this city has named the M. P. Gould Co., Inc., of New York, to direct its advertising account.

Lindbergh Field Formally Opened

Airport at San Diego Dedicated with 222 Service Planes in Maneuvers

SAN DIEGO, CALIF—The Navy exhibited its aerial strength on Thursday, August 16, at this city, when 222 planes of various classes flew over the city for two hours in changing formations. This total number included 82 Army planes. The occasion was the dedication of Lindbergh Field, San Diego's airport now under construction. Planes taking part came from the Aircraft Squadron, Battle Fleet, now based at the North Island Naval Air Station; Rockwell Field and March Field.

Three outstanding spectacles marked the day's performance—a "strafing" attack on the field by the Navy's bombing squadrons, a remarkable series of aerial acrobatics by the "Three Sea Hawks" of the battle fleet air squadrons, and the laying of a smoke screen by seven naval planes at the conclusion of the day's events.

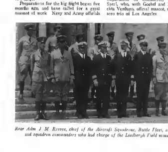
Performances are Faultless

In commenting upon the flights, Admiral Reeves declared that it was entirely successful. The orders were all made out for the squadrons under his command, and were carried out faultlessly, although he was far from the seat of operations at the time. Similarly good work was performed by the Army planes, gathered from air fields all through the West.

While the flight was in progress, the aircraft carriers *Lexington* and *Saratoga* were lying at anchor on Coronado Beach, and water taxis were taking visitors to them. About 450 passengers went to the two ships.

Preparations for the big flight began five months ago, and have called for a great amount of work. Navy and Army officials have co-operated and the aviation department of the local chamber of commerce has been extremely busy with details.

Mayor Harry Clark introduced the distinguished guests, who included many of the outstanding figures of the nation's air development. Among them were Capt Hubert Wilkins of North Pole flight fame; Col. William Thaw of the Layfayette Escadrille; Lieut. Gov. Buron Fitts, who dedicated the field; Congressman Carl R Chindblom of Chicago; Lieut. Art Goebel, winner of the Dole prize; Rear Adm. Joseph M. Reeves, commanding the Aircraft Squadrons, Battle Fleet; Rear Adm. A. H. Robertson commandant of the 11th Naval District; Brig. Gen. Dion Williams, commanding the Marine base here; Brig. Gen. Ralph H. Van Deman, commanding the Sixth brigade of the Army; Eddie Rickenbacker, World War ace; O. O. McIntyre, journalist; Councilman Peter Witt of Cleveland; Judge William J. Hunsaker of Los Angeles and four members of the air race committee from Los Angeles, Theodore Hall, D. E. McDonald, J. F. Jeffries and R. J. Pritchard; Capt. Walter Parkin, inspector for the Department of Commerce, and Harry Sperl, who, with Goebel and Miss Carmelita Verdugo, official mascot, make up the aero trio of Los Angeles.



Rear Adm J M Reeves, chief of the Aircraft Squadrons, Battle Fleet, and his staff and squadron commanders who had charge of the Lindbergh Field maneuvers

Bolling-Mitchel Time Bettered

NEW YORK, N. Y.—All time records between Bolling Field, Washington, D. C., and Mitchel Field, L. I., were broken recently when Lieut. Ford J. Lauer and 1st Lieut. Gordon P. Saville, both of Mitchel Field, each piloted a Curtiss O-1 observation plane over the 240 mi. distance in the exceedingly fast time of 70 min. The usual time for this type of plane is said to approximate 2 hr. 20 min. A strong wind from the west encountered at 2,000 ft. enabled the fliers to establish their record.

Goebel Makes a 19 Hr. Cross-Continent Flight

CURTISS FIELD, L. I.—Making the first West-East non-stop flight over the continent, Col. Art Goebel, winner of the Dole Race to Hawaii, landed his Wasp powered Lockheed Vega monoplane "Yankee Doodle" at this field at 11:08 A. M. Monday August 20. Colonel Goebel completed the flight from Los Angeles in 18 hr., 58 min., thus breaking the mark of 26 hr. 50 min. established in a non-stop East-West flight from New York to San Diego by Lieuts. John A. Macready and Oakley Kelly May 2-3, 1923.

The takeoff from Los Angeles was made at 12:06 P. M. Pacific Standard Time August 19 with a capacity load of 450 gal. of gasoline carried. The routed path led across the continent over Arizona, New Mexico, Texas, Oklahoma, Kansas, Missouri, Illinois, Indiana, Ohio, and Pennsylvania. Maximum speed during the flight was put at 175 m.p.h., of which the Yankee Doodle, powered by the Pratt & Whitney 400 hp. Wasp engine is said to be capable. Colonel Goebel was accompanied in his journey by Harry Tucker, Santa Monica capitalist and announced backer of the flight. The Yankee Doodle is the same Lockheed plane in which Pilot Lee Schoenhair and Tucker attempted a West-East non-stop flight some weeks ago. In that attempt, the fliers were forced down by fog in the vicinity of Columbus, O.

Colonel Goebel will fly the Lockheed Yankee Doodle back to San Diego in the trans-continental event of the National Air Races scheduled early next month.

Winston-Salem to Hold Air Meet September 1

WINSTON-SALEM, N. C.—Promising to be the outstanding feature in aviation circles in North Carolina and this part of the South, the Piedmont Carolina Aviation Meet, will be held at Miller Municipal airport, here September 1.

The meet is expected to bring to the local field one of the largest aggregations of planes and pilots ever seen in the State. Invitations have been extended generally to all pilots in the South and quite a few acceptances already have been received.

The local chamber of commerce is sponsoring the event and all local civic and business organizations are co-operating. To date, 12 cups have been provided as prizes for the winners in the various events.

Monocoupe Adv. in Liberty

NEW YORK, N. Y.—Aiming to put its product directly before the general public, Mono-Aircraft, Inc., of Moline, Ill., ran a special full page advertisement in the August 18 issue of *Liberty* magazine. The space taken for the company's display ran over two bottom half pages in spread fashion, with the Monocoupe plane and Velie radial engine pictured in the central portion.

AIRPORTS AND AIRLINES

Northwest Airways Air-Rail Line to Start

ST PAUL, MINN—Joint air-rail passenger service between the Northwest and the East will be inaugurated Sept 1, when a plane of Northwest Airways, Inc., affiliated with Transcontinental Air Transport, will leave St. Paul at 8:40 A. M with passengers who will catch afternoon trains from Chicago to New York and other Eastern cities. It had originally been planned to open this service August 20, but extra time was needed for the delivery of the two Hamilton Metalplanes which the company will operate.

Under the schedule, which was worked out by the air line officials and representative railroads, planes will connect at Minneapolis and St Paul with six trains from the West. The run will be made to Chicago in three and one half hours, enabling passengers to catch the train to Eastern cities.

On the West-bound run the plane will leave the Municipal Airport in Chicago at 3 P.M. Because of prevailing easterly winds over Wisconsin, the return trip will take four hours, landing passengers in St. Paul at 7 P. M., and in Minneapolis 10 min. later. On this run connections will be made at Chicago with trains from New York, Boston and Detroit. At the Twin Cities it will be possible to catch practically every important westbound evening train to the Pacific coast, Canada and Northwest states.

Announce Texas Fields At Palestine and Llanc

PALESTINE, TEX—Jacob Platt of Palestine has donated the city a plot of ground just north of town for a municipal airport. The airport will be improved by the city and county. A beacon, hangars and grading work will be among the improvements started at an early date. The new airport is located on a paved highway. It contains 25 acres.

Another field is also announced at this time by Llano, Tex. At this city an emergency field has been established in the Robinson State Park, which is located on Highway 29 and the Llano River at a point two miles west of town. The field is more than 1,000 ft. long and 500 ft. wide.

Hangar Contract Let

MINNEAPOLIS, MINN—The United States Naval Reserve V. N. 11 has let the contract for construction of a brick and metal hangar, 80 x 90 ft., at 60th Street and 54th Avenue, South, at $14,500, to be completed October 1.

Plan New Airport In Miami Harbor

MIAMI, FLA—A new plan, including aviation in the proposed Miami Harbor development, provides for the construction of a new causeway having a large filled in area to be used as an airport for commercial planes and another to be used as a base for government aircraft. This causeway will be the fourth to be built across Biscayne Bay and will connect a point near Point View to the Southwestern tip of Virginia Key.

To Dedicate De Beque Airport on Labor Day

DE BEQUE, COLO—Dedication of the De Beque Airport is scheduled for Labor Day, September 3, it is announced. The celebration will include a rodeo, barbeque horse race, dancing, etc. Maj. J. Paulding Edwards, engineer in charge, announces that the field contains 850 acres of practically level ground. It is far enough away from the mountains to be free from air currents and eddies.

The field is laid out in the form of a figure 4. The north-south runway is 7,000 ft. and the east-west runway 5,500 ft. The cross bar of the figure will be 4,500 ft. long. This will give fliers the advantage of the wind, regardless of from which direction they approach, and a mile run for their takeoffs.

A feature of the lighting is contained in the fact that natural gas will be used. An inexhaustible supply of gas underlies the region, and, if necessary a well may be drilled on the site to provide illumination fuel.

Buffalo Firm Leases Building near Airport

BUFFALO, N. Y—Sky View Lines, Inc., has leased from the Buffalo city council the old Trap and Field Club building adjoining the Buffalo airport. The lease which was drawn up by the corporation counsel was dated August 1 and will expire May 1, 1930.

According to the plans of the Sky View Lines the company will remodel the building into a passenger station, construct runways, improve the property and indemnify the city against loss caused by accidents. The approximate cost of the work will be $25,000, according to Neal Van Popern, managing director and Stuart A. Howard, member of the board of directors of the company.

Mark All Towns In Iowa County

Sign Placed on Outstanding Buildings in Each of 12 Towns

CEDAR RAPIDS, IA.—A 100 per cent record for air marked towns has been established by Carroll County, Ia. and it is believed to be the first county in which the name of every town is painted on an outstanding building. Business men bankers, civic bodies and other groups have cooperated in each of the towns to provide these markers according to an announcement made recently by Cedar Rapids Airways, Inc.

One sign has been erected in each of the twelve towns of the county. Of this number four have been sponsored by merchants and business men. These include the town of Carroll, where a sign has been erected by the Swaney Auto Co. on the roof of its building, Ralston, where a marker has been placed on the Toyne Department Store by the business men of the town, Manning, where the Dultmeier Manufacturing Co. has placed the name of the town on the roof of its factory, and Lidderdale where a sign has been placed on the building of the Joyce Lumber Co. by the business men and Father Joseph Underberg.

Banks Mark Four Towns

Banking institutions in four of the towns have sponsored the placing of markers on buildings. In Templeton a sign has been placed on the Schoeppner Motor Co. Building by the Peoples Savings Bank and in Dedham the name of the town has been placed on the Schreck Building through the efforts of the Dedham Savings Bank. A sign on the public hall building at Halbur was sponsored by the Farmers Savings Bank and a similar indicator has been placed on the Lammers-Olerich Block in Breda by the local savings bank. The State Savings Bank and the Fullerton Lumber Co. of Lanesboro have cooperated in placing a marker on the building of the lumber company.

Other Groups Cooperating

In Glidden a sign has been painted on the school building by the Community Club and Arcadia has been marked on Peters Brothers Garage in that town by the People of Arcadia. Dr. Wolfe and the Commercial Club of Coon Rapids have provided a sign on the Koester Lumber Co. building.

Completing Fine Le Roy Airport

New York Millionaire Who Bought Friendship Operating Fleet of Planes

LE ROY, N. Y.—Destined to be one of the finest fields in the State, a 140-acre airport is being completed here off the main Buffalo highway at the outskirts of the village by Donald Woodward, millionaire air enthusiast. Woodward, who has a fleet consisting of four OX-5 Wacos, a Whirlwind powered Fairchild cabin plane, and a Curtiss Seagull powered by a C-6 engine, is now in Europe, where he is making arrangements to bring the trans-Atlantic Fokker monoplane Friendship, which he recently purchased, back with him to Le Roy.

When the new hangar, shops, offices, and field are pronounced in shape, a full aeronautical program will be inaugurated at the Woodward airport by the D. W. Flying Service, Inc., of which Woodward is president. Capt. Russell Holderman, veteran flier, is vice-president of this company, while Leonard Hemlich is secretary and H. Kirk Tennent, treasurer.

Completing Large Hangar

"An outstanding feature," declared Captain Holderman in an interview, "will be the pilots' school, which will be complete in every detail. Comprehensive courses in aerodynamics, navigation, and mechanics will be included in a thorough ground schooling," he said, "while the regular flying instructions on the Wacos will be followed by cross-country work in Curtiss Robin planes, two of which we have ordered. The Curtiss Seagull, on the other hand, will be utilized for seaplane training."

Four fine runways, varying from 400 ft. to 800 ft. in width and covered with fine crushed stone rolled to a smooth surface, are now nearly ready at the Woodward field. In length, the north-south, north-west-southeast, and northeast-southwest runways measure 2,800 ft. The north-south runway, on the other hand, is 3,300 ft. long and lies in line with the prevailing wind.

School to be Feature

The hangar, being built under Holderman's direction, is 80 ft. by 140 ft. It is floored with concrete and has a 60 ft. concrete apron outside the rolling doors. More than a dozen airplanes of ordinary size may be housed here.

Next to the hangar, a lean-to has been constructed running the entire length of the building and terminating in a three-story tower. The ground floor of the latter structure will contain an operations office, the second floor will be built into a rest room with showers and their conveniences for women fliers and visitors, and the top floor will be a pilots' clubroom with large windows commanding views of all parts of the field. A beacon is to be installed at the apex of this tower.

An Engine Warming Device

In the lean-to there will be a complete machine shop, a stock room with a supply of replacement parts for the various planes at the field, an airplane repair room, and a locker and shower room for pilots. There will be a special hot air vent system in the storage section for warming engines during the winter nights preparatory to morning take offs. Steam heat, by this system will be piped under the tarpaulin covering of an engine. Another feature will be a spectators' grandstand atop the lean-to.

Otto Enderton, former mail pilot, with air hours numbering in the thousands, is flying the Woodward Fairchild plane at present in a passenger sightseeing service. He will act as instructor in the new school.

Nebraska Cities On Continental

LINCOLN, NEB.—Lincoln, as well as Ashland, Seward, York, and Aurora, will be on the regular transcontinental airmail route by October 1, it was said recently by Captain F. C. Hingsburg, director of airways for the Department of Commerce, who was in Lincoln for a short time.

Establishing of the route, and preparation of the landing field, beacons, and other necessary equipment is to begin immediately.

To Dedicate Sunbury Airport September 1-3

SUNBURY, PA.—Ceremonies to mark the dedication of Sunbury's 125 acre airport will take place September 1-3. An invitation is extended to all pilots and planes who can be present for the dedication.

The program will open on the evening of August 31 with a banquet and entertainment, on the Neff Roof Garden for all guests, sponsored by the Sunbury Flying Club, Chamber of Commerce and Kiwanis Club. On September 1 the field will be dedicated to Wesley L. Smith, superintendent of Eastern division National Air Transport. These ceremonies will be accompanied by Army maneuvering, stunt flying, and lunch for visiting pilots. The evening will be devoted to a display of fire works and the entertainment of guests. On September 2 and 3 the program will include aerobatics, parachute contests, bombing contests and dinner for guests at Susquehanna Valley Country Club.

Sunbury's Airport has accommodations for all sizes and classes of planes. A new hangar has been erected and electric gas and water pumps have been installed. The runways are 3600 ft. east and west, and 1500 ft., north and south.

Long Island Field Dedicated

ROCKVILLE CENTER, L. I.—Sunrise Airport, a field comprising 80 acres in the northeast section of town, has been dedicated. The land, which is known as the "Old Dry Reservoir," has been given to Rockville Center by Robert West, local owner of the tract. More than 400 persons attended the dedication.

Donald Woodward, who heads the D. W. Flying Service, and Vice President Russell Holderman.

Minneapolis-Duluth Line Uses Seaplanes

MINNEAPOLIS, MINN.—One of the first seaplane passenger lines in the United States is now operating out of this city following the recent establishment of seaplane service between here and Duluth Minn., by Northern Air Lines Inc., a division of the Universal Air Lines System.

Inability of the air line company to locate a suitable landing field at Duluth resulted in the use of pontoon equipped Ryan Broughams for the service. The planes flying at an altitude of 3000 ft. are constantly within landing distance of at least five of the 10,000 lakes that dot the state of Minnesota.

The planes land and take off from Lake Calhoun in Minneapolis less than 10 min. from the loop district. At Duluth the mouth of the St. Louis river, leading into Lake Superior, is employed. This is also in the heart of the city. A plane leaves Duluth daily at 8.30 A. M., arriving in Minneapolis at 10.15 A. M. It leaves again at 4.15 P. M. and arrives back in Duluth at 6 P. M. The company contemplates using a plane equipped with skiis for service in the winter.

Committee on Marking Soon to Make Reports

WASHINGTON, D. C.—The work of the National Airway Marking Committee, which grew out of the Airways Marking Conference held May 10 and 11 at Wichita Kan., is progressing satisfactorily and according to its chairman, Harry H. Blee chief of the airport section of the Aeronautics Branch, Department of Commerce the committee probably will render its preliminary report in the near future. This report immediately will be broadcast to the Aircraft industry and to civilian pilots throughout the United States with the announced purpose of receiving criticisms and suggestions.

The committee began its studies many weeks ago with a careful survey of the hundreds of suggestions submitted at the Airways Marking Conference. The committee has taken the various ideas represented and placed them under test.

Expand Fisk Park Airport

HOLYOKE, MASS.—Twenty-two acres of land have been added to the Fisk Park Airport making a total of 125 acres to facilitate landing the passenger plane to be bought by the concern. Plans are being developed to afford landing facilities for a plane of any size, Mr. Edgar Stone manager of the airport, said.

Building Seaplane Landing

LOS ANGELES, CALIF.—Construction has begun on a marine airway and boat landing at berth 192 and 179, Los Angeles Harbor, in San Pedro Annex.

Oakland Reports Now Teletyped

OAKLAND, CALIF.—Four teletype machines have been installed in the circuit between Oakland and the radio station at Concord, Calif. By remote control, these machines type out the weather reports and other flying information valuable to mail and passenger plane pilots.

Midwest Firm Opens New Field at Aurora

MONMOUTH, ILL.—The Midwest Airways Corp. has opened a new flying field at Aurora, Ill., and will establish headquarters for the company at the airport which is located adjacent to the exposition park north of the city. The field was opened by John H. Livingston, president and general manager. The company also operates fields at Monmouth and Waterloo, Ia.

A 15 plane steel hangar located on the north side of the field has been completed. The Aurora field has been lighted as an emergency air mail landing field for the Chicago Kansas City route. It will serve as sales and service headquarters for Waco and Ryan airplanes in the metropolitan area of Chicago being located only 20 min. by air from the Loop. Service facilities and repair parts will be available. The Midwest Airways Corp. distributes Waco and Ryan airplanes in Illinois and Iowa and is establishing a chain of fields in the two states.

To Dedicate Burke Airport

OKMULGEE, OKLA.—Four hundred dollars in prizes is being offered by the local chamber of commerce in races to be featured at the September 1 dedication of the new William A. Burke Airport here named after one of Okmulgee's pioneer fliers.

An "On to Okmulgee" race with $100 as the first prize is being offered, in addition to all gas and oil being offered free. Races over a 30 mi. triangle tract with $75, $50 and $25 as prizes in each group are also being planned.

Springfield-Montreal Service

SPRINGFIELD, MASS.—Weekly service in Ryan Broughams between Springfield, Mass., and Montreal Canada, has been announced by the Massachusetts Airways Inc. of this city. The trip occupies only about two hours and one-half and is expected to meet with increasing popularity in the ensuing summer week-ends.

Massachusetts Airways Inc., New England distributors for the Ryan Brougham recently reported the sale of two of these planes.

Reviews

The Book Department, Aviation, 250 West 57th St., New York City, can supply all books mentioned except government publications. N.A.C.A. publications may be obtained upon request from the National Advisory Committee for Aeronautics Washington, D. C.

"*Building and Flying Model Aircraft*" is the title of a new handbook for model plane builders and tournament contestants, which has just been placed on the market. It was prepared for the Playground and Recreation Association of America, Inc., by Paul Edward Garber, model aircraft consultant for the organization, which is noted in the aeronautical field for its National Playground Miniature Aircraft Tournament.

The book is an enlargement of a series of bulletins prepared by the author for the playground association during the summer of 1927. It is quite complete. Among the subjects dealt with are elementary aircraft, gliders, tools and materials for use in model aircraft construction, model propellers and fittings, accessories for flying models, tractor chassis and scale models, model balloons, compressed air engines, model airplane clubs and contests, and the uses of model planes. In addition there are detailed descriptions of the "Sizzlefoot", the "monowing" model, the "Humming Bird", the scientific model airplane, "P. E. G.-54", the "Lange-3" plane and the winning model in the 1927 tournament conducted by the playground association.

Complete working drawings, lists of materials and instructions are given in the book for each of the models described. Highly technical terms have been avoided so that the descriptions may be followed easily by anyone. It is believed that the book will be a tremendous help as a textbook for model aircraft enthusiasts, students of elementary aeronautics, committees in charge of model aircraft tournaments, model clubs, recreation leaders and manual training instructors who are incorporating the building of model planes in their courses. The price of the book is $2.25.

* * *

A Financial History of the American Automobile Industry is the title of a new book by Lawrence H. Seltzer, PhD., associate professor of economics and sociology in the College of the City of Detroit. The book is a 1926 winner in the annual Hart, Schaffner and Marx prize essay contest, conducted for the purpose of interesting American youth in the study of economic and commercial subjects.

With reference to the automobile industry, the author tells how the manufacturers have come to command the economic resources required for the extensive production of their important product. The book presents quite a comprehensive study, describing the developments of the industry in general, Ford Motor Co., General Motors Corp., and other large manufacturers.

It is believed that the book will prove of interest to those in the aviation industry. The price is $3.00.

FOREIGN ACTIVITIES

Unique Features in British Plane

Wing Panels and Empennage Members are Interchangeable in Simmonds Spartan

HAMPSHIRE, ENGLAND—One of the most interesting airplanes entered in this year's King's Cup Race was the Simmonds Spartan biplane which was flown by Lieutenant Wilcox, winner of the Schneider Trophy. The plane is a two place single bay design and is powered with an 20 hp A.D.C. Cirrus Mark II engine. It was designed by O. E. Simmonds, of Holmfels, Woolston, Hampshire.

The outstanding feature in the design of the Spartan is interchangeability of units which effects a remarkable saving in spare parts required for replacement or repair. All four wing panels are interchangeable and either of the two elevators can be used to replace the rudder. The stabilizer is divided into three parts, a short center section and two tip sections. Either of the tip sections may be used as a vertical fin. It is therefore evident that a set of service replacement parts would include only a single wing panel, aileron, fin and rudder. All of the main bracing wires are of equal length.

The first Spartan, which bears the Air Ministry letters G-EBYU is constructed with wing panels having fittings on both surfaces. This has been done to show the maximum reduction in performance caused by fitting the plane entirely with spare parts. On the standard plane the wing panels would be equipped with fittings on only one side.

Provision has been made to fold the wings back facilitating storage in small space and the plane can be towed behind an automobile with wings folded. To fold the wings it is only necessary to remove one hinge pin. A large baggage compartment is built into the fuselage. A large door is fitted for easy access to each seat. Visibility from either cockpit is exceptional.

Quebec to Have $100,000 Field

QUEBEC, CANADA—A new airport to cost $100,000 is to be completed here by Canadian Transcontinental Airways, Ltd, by November 1, it has been announced, which will be in time for the establishing of a winter air mail service.

The field will be approximately 2,500 ft. in length, the same distance in width, and will have six runways in the form of a star. It will be equipped with modern hangars, mechanics' huts, a weather bureau, and flood lights for night landing. While this is announced as a private enterprise, it is believed that financial assistance will be had from both the Federal Government and the City of Quebec.

Turkish Air Line Considered

CONSTANTINOPLE, TURKEY—Establishment of an air line between this city and Anatolia is under consideration of Turkish Government officials according to announcement made here recently. The line will be used for mail and commercial service in the regions not served by railroads.

A side view of the Simmonds 20 hp Cirrus Mark II powered Spartan biplane

Canada Uses Keystone Planes in Crop Dusting

WHYCOGOMAH, NOVA SCOTIA—Wright Whirlwind powered seaplane dusters built by the Keystone Aircraft Corp. of Bristol, Pa., have been used by the Canadian Government in a series of experiments to determine the feasibility of dusting forests and crops with insecticides by means of airplanes. In the first tests nearly seven tons of the poison was spread over spruce forests to kill the bud worms. This work would have taken 17 weeks if performed by the ground personnel and was done in 17 hr. and 20 min by airplane.

Another experiment of similar nature was carried out in Winnipeg, Manitoba, where wheat rust had injured the crops. An area of 345 acres was covered in 8 hr. and 20 min with 3900 lb of dust. In view of the satisfactory results of the work carried on this fall, the Department of National Defense in Canada expects to extend their operations to include other areas and other crops being damaged by pests and diseases.

Sham Air Raids Show London Is Vulnerable

LONDON, ENGLAND—Sham air raids have recently been made in maneuvers over London covering a period of five days and involving large fleets of bombing and fighting planes. Four sections of the city were theoretically bombed continually by the "enemy"—Richmond Park, Wormwood Scrubs, Woolwich, where there is a military arsenal, and Croydon, the great English air terminal.

The consensus of the British press, which was allowed to fully report the maneuvers, indicated that London was quite vulnerable to attack from the air. It was estimated that in actual warfare, half of London would have been laid in ruins, while many hundreds of thousands of the population would have been killed by poison gas bombs dropped by the enemy.

Broad Makes New Record

LONDON, ENGLAND—Using the latest type DH Moth plane with a new Gypsy engine developing 85 to 100 hp. Capt. Hubert Broad recently broke the endurance record for light airplanes. He took off from Stag Lane airdrome and remained in the air just 24 hr. The nearest unofficial light plane record to that of Broad was the 13 hr. flight of Bert Hinkler on the first leg of his

THE BUYER'S LOG BOOK

Aerol Struts

AEROL SHOCK Absorbing Landing Struts are telescoping cylinders inflated with air and installed between the wheels and fuselage of the plane. They are manufactured by the Cleveland Pneumatic Tool Co., Cleveland, O., makers of various pneumatic devices.

Installation of Aerol Strut on Plane

Aerol struts are designed to absorb the initial and secondary impacts of landing by building up air pressure in the cylinders, slowly at first but with a gradually increasing rate as higher pressures are reached. With the energy absorbed in the compressed air, a recoil check comes into play and prevents the built up energy from throwing the plane back into the air.

This is accomplished by a piston and valve mechanism utilizing compressed air and oil. The initial impact is transmitted to the strut piston which absorbs the shock by sliding up into the cylinder, building up air pressure as it moves. Thus the shock is absorbed in progressive ratio. At the top of the piston stroke the oil controlled return check automatically operates to prevent recoil. The increased air pressure is dissipated through hydraulic action, returning the piston to normal piston ready to meet with the second impact. All rebound except that of the tire is entirely eliminated even when the impact is equal to several times the weight of the loaded plane.

Under conditions of normal taxying the strut is compressed to approximately 75 per cent. of its full extension. It is therefore evident that the static load of the plane causes the piston to move only 25 per cent. of its stroke. This 25 per cent. compression provides flexible air cushion for taxying and also forms the cushion for the initial landing impact.

Kant-Rust

MANY USES have been found in the aircraft industry for Kant-Rust as a lubricant and rust penetrative and preventive. Kant-Rust consists of a lubricating fluid containing finely divided graphite in permanent suspension. It is manufactured by the Kant-Rust Products Corp., of Rahway, N. J.

The graphite used in Kant-Rust is made by a patented process owned by the Acheson Company and is called by them "deflocculated graphite." By this it is meant that the graphite is reduced to the smallest particles in which it can exist and still retain its individuality. Thus the minute graphite particles become part of the liquid and are carried to the most remote portions of the surface to be lubricated.

It has been shown by tests that the addition of graphite to a lubricant increases its life and lubricating value.

Esline Hangars

ESLINE ALL steel hangars and airport buildings are being used extensively by aircraft operators in many parts of the country. These hangars are popular because of the simplicity of assembling and a large majority of purchasers perform the erection work themselves using only the instruction furnished by the factory with each hangar. The Esline Company has general offices at 610 Michigan St., Milwaukee, Wis., and dealers in most of the principal aircraft centers.

The type of hangar shown in the accompanying illustration is manufactured in all sizes up to 100 ft. clear span and in any height or length. Doors are designed to slide on track inside of hangar. The super structure is quickly assembled by heavy bolts and the roof is smoothly lined with insulite. Rough edges are protected by Esline galvanized joint channels. Full inside wall height is allowed and knee braces are eliminated by outside truss bracing for the heavy channel columns. The completed hangar is a rigid and sturdy building and a valuable addition to any airport.

The Esline Hangar recently built at Sheboygan Airport

Incandescent Lamps

INCANDESCENT LAMPS are being used extensively in the lighting of airports and airway markers and for many other purposes in the aeronautical industry. A full line of all sizes and types is manufactured and carried in stock by the Westinghouse Lamp Co., of Bloomfield, N. J.

Signs and markers can be illuminated by direct lighting, which includes floodlighting and the use of distributed units, outline lighting and the use of translucent panels. The method of employing distributed units utilizes a series of reflectors equipped with incandescent lamps. The reflectors are usually mounted on pipe supports at a height of not less than one-half of the spacing distance. For floodlighting standard projectors are used.

Outline lighting, which is used commonly in commercial electric signs, consists in outlining the letters of the sign with small incandescent bulbs on 6 to 12 in. centers. In the third of the above mentioned methods the incandescent lamps are mounted under translucent glass strips arranged to form the letters or symbols.

Aviators' Pliers

The influence of aeronautics on the design of small hand tools is indicated in a set of three special pliers now offered by the Forged Steel Products Company, Newport, Penn., under the name of the "Aviator Kit"

Special Aviator's Kit

Recognizing that light weight is an essential factor in any item of airplane equipment, these pliers have been designed with special reference to that requirement, but their lightness entails no sacrifice of strength. They are hammer forged from electric furnace alloy tool steel, individually hardened in liquid heat process and electrically tempered thru and thru, in distinction to surface-hardening.

Foremost in the group is a general use plier of exclusive design with a long thin nose brought to a decided point. Its chief features are hand-filed cutters that cut with ease, deeply milled gripping teeth and end grip, adjustable joint for expanding the gripping jaws and "vacuum grip" non-slip handles. The length of this plier is 7 in.

For working in confined spaces inaccessible to ordinary pliers, the mechanic will find the 6 1-2 in. long needle nose pattern a helpful adjunct. This pattern is also fitted with cutters and is deeply milled at the extremity of the jaws for securing a tight hold. The handles and jaws are spring tempered.

The diagonal cutting nippers, shown in the illustration, measure 6 in. in length. They are light in weight, but are built for heavy duty work. This special Aviator's Kit, weighs only 18 oz.

Dot Grease Pump

TO MEET the demand for a medium capacity, hand operated grease pump the Dot Lubrication Division of the Carr Fastener Co., 31 Ames St., Cambridge, Mass.,

Pump opened and ready to be filled

has developed and placed on the market the Dot Little Giant grease pump. The new pump has a capacity of five lbs., weighs only 23 lbs., filled, and develops pressure

up to 10,000 lbs. It is equipped with Alemite, Zerk and Dot nozzles.

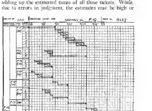
One of the interesting features of the Dot pump is its ability to develop unusually high pressure with little effort on the part of the operator. The entire body of grease in the tank is held under constant pressure by a heavy spring working between the pump cap and a plate attached to the bottom of the pump unit. By a simple rack and pinion mechanism the grease is drawn through a screened opening in the plate and delivered through a series of cylinders to the booster clyinder at the top of the pump. There by the operation of a booster piston, a pressure of 10,000 lbs. may be developed.

Specifications of the Labor

(Continued from page 597)

board clerk who takes his ticket for the job just completed and stamps it with the time stopped. He then advances to the top pocket one copy of the ticket for the next job to be done, and gives the other to the workman, first stamping them with the time started. He also gives the workman the drawings, instruction sheets, etc. that go with the job. On the original copy of the ticket for the work finished the quantity produced will then be entered by inspector or weigher, and it will be sent to the office to be rated, extended, checked with payroll, and posted to costs. The duplicate copy from the control board may be kept for a time by the clerk as a record of jobs finished each day.

The amount of work ahead of any machine is shown by the tickets in its pockets on the board. The total estimated time required to perform this work is obtained by adding up the estimated times of all these tickets. While due to errors in judgment, the estimates may be high or



Production chart for intermittent operation.

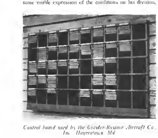
low on individual tickets, these errors will largely balance each other if a considerable number of tickets be taken. For the determination of work ahead, therefore, the accuracy of exact time studies is not essential. The judgment of the superintendent or foreman, or of a man familiar with the work, will give very good results.

When such a plan has been put in operation it is commonly found that some machines or work places will have but little work ahead of them, while others will have a

great accumulation. These latter are the "bottle-necks" which hold back the flow of production. Sometimes study of the congested operations shows that they are not being done efficiently. On these accurate time study brings its greatest and quickest returns, and here is where it should be started.

If new work be scheduled against a machine which already has much ahead of it either the new must wait its turn or else work already scheduled must be displaced and set back to make room for it. If this latter be impracticable then the new job will just have to wait. If this complete new job has many parts and operations it will frequently happen that while many of them can be put through promptly a few will take longer or will be held back by the congestion at one or two machines and will delay the whole assembly. Sometimes work partly completed on the assembly floor has to be stopped because some minor part is not at hand and cannot be produced promptly. The elimination of such delays requires not only the scheduling and dispatching of work by the control board, but the preliminary planning of it as well. This means that the ordering date of each part shall be so set in reference to the date it is required that, whether from stock, purchase or manufacture, every part shall come to hand when it is needed, neither too soon so that it lies around and gets lost or injured, nor too late, so that it delays the assembly.

The skillful planning of production is like a game of chess: every piece on the board, its possible moves must be kept in view. It is also like the planning of train movements over a network of branches, sidings, and junction points on a railroad system: the positions, movements, and meeting points of all trains must be in the dispatcher's view. An expert chess player can visualize his board and make his plays blindfolded. A train dispatcher requires some visible expression of the conditions on his division,

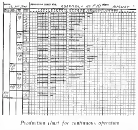


Control board used by the Kreider-Reisner Aircraft Co., Inc., Hagerstown, Md.

and secures it through his diagram of connecting points and train movements. The planner of production requires similar help. The nature of this help depends on the character of the production. If it is simple, standard and continuous, little is required. If it is discontinuous and complicated, it may be desirable to have a very complete graphical planning system covering all parts and assemblies, with constant check ups and corrections.

Here, as before said, the airplane and engine industries will occupy an intermediate position. As the parts be-

come more standardized, and are produced and stocked in larger quantities, the final assemblies will become more sure matters of taking and assembling finished parts from an adequate stock. Also, the production of those parts can be arranged more and more in large lots and regular sequences on equipment adequately provided for the defi-



Production chart for continuous operation

nite ends in view. The assembly will then require but little specific planning. It will go through in a steady stream as automobiles do now. And when the quantity of any part becomes great enough so that a specific group of machines is kept in continuous operation to produce it, very little planning will be required for it. However, insofar as different kinds and lots of parts, required on specific dates, are made on limited orders which must accompany each other in production and follow each other over the same machines without interference, careful planning will be required.

On standard, repetition assemblies this planning may consist of filling in with the specific dates a standard chart showing at what stage of the assembly each elementary part is required, and the length of time that must be allowed to produce it. These dates cannot be filled in at free will, but only after comparison with the conditions of work ahead, as shown by the control board, and after such changes and rearrangements of the work scheduled for other orders as it may be permissible to make. Here is where the chess game comes in. On special, non repetition work no such standard plans are available: special layouts have to be made, and the work is even more difficult though not impracticably so. In the aeronautic field, however, it will be increasingly possible to make use of standard production charts.

In the heavy horizontal lines this chart shows graphically the time required to perform each operation on each of the five parts, two sub-assemblies, and the final assembly of an article No. F-10. These production times and the starting dates of each part are so arranged as to bring all parts to completion just when needed—an ideal condition not always easy to attain. For standardized work these charts without order numbers or dates are prepared in advance by hektographing or blueprinting. When an order is to be scheduled one of the blank charts are taken and, after reference to work ahead as shown by the control board, the date when each operation should be started is filled in on it. The pre-written labor tickets are then

scheduled on the control board to be run on the dates set

By the use of dotted or colored lines parallel and adjacent to the full heavy lines, and representing the actual daily productions on the order, in terms of normal days works, such a production chart may also be made to show the actual progress made on each operation A complete picture of the state of affairs on the order is thus presented

Charts like this are most useful for planning and controlling production where complicated products are put through in isolated lots But for parts regularly made and coming through in a steady flow, so that the detailed preliminary planning is not called for, only the daily and cumulative progress need be presented The charts will take a form similar to that just shown, but only the current actual production on each operation will be given

To illustrate the difference, this chart has been drawn to cover the same assembly and parts as in the preceding example, but for continuous instead of occasional production This is only one of several ways in which these facts might be presented Simple cumulative tabulations of productions, in parallel columns, might be used, and would involve less work than charting, but are less informative Also, more complicated combinations of lines and symbols in different colors have been devised. Since the whole production suffers if but one part falls behind, the essential thing is to make evident whether all parts and operations are marching along in step at the predetermined pace For this, the forms illustrated are well adapted However, it may be pointed out that these methods will be ineffective unless used and followed up by a wide-awake production department

This completes the consideration of methods of production control In the next article the forms and uses of labor tickets will be taken up

The Timm Biplane

(Continued from page 595)

to the cabin is by means of a large door on the left side of the fuselage Four large windows equipped with sliding glass are provided in each side of the cabin A large door opening into the baggage compartment is provided on the outside of the fuselage on the left side

The pilot's cockpit is unusually roomy, all controls and instruments being most conveniently arranged Control surfaces are operated by wires passing over micarta pulleys All wires to the tail pass down and under the passenger cabin between the floor and the fairing Although not carrying landing lights or flares as standard equipment the plane is equipped with navigation lights and a lighted instrument board Pilot's vision is excellent due to the location which is quite high and is well back from the engine installation Struts and wires do not interfere with the visibility In landing the wheels are visible from the pilot's seat

While the normal gasoline capacity is provided by two 35 gal gasoline tanks mounted in the center section of the upper wing, for the purposes of the endurance flight the cabin has been fitted with additional tanks giving a total fuel capacity of 715 gal. A 40 gal oil tank is mounted forward of the pilot's cockpit and directly behind the engine.

The wing arrangement is that of a single bay biplane Both wings have the same total span of 45 ft and the same chord which is 6 ft They are rigged with a gap of 6 ft 9 in and a stagger of 3½ in There is no sweepback and no dihedral, the angle of incidence being one degree for the lower and two degrees on the upper wing The lower wing is built in two panels each of 20 ft 8 in span, which are joined to the fuselage at the lower long ron The upper wing is built in three panels, two of 18 ft 6 in, and a center section of eight feet, which is plywood covered

The single N strut is located at 15 ft 6 in from the center on each side and the wire bracing consists of lift and landing wires running in a vertical plane, all drag stresses being taken within the wings themselves and to the fuselage by the N struts at the center section Double MacWhyte streamline wires are used for all external bracing

The wing structure is conventional, employing box spars with spruce caps and two-ply 45 deg Haskelite sides, while the ribs are of spruce in Warren truss struc-

Rear quarter view of the Timm Biplane

ture with the cap strips reinforced by plywood flanges to resist buckling and to keep the true shape of the curve Drag bracing within the wing is single wire while compression members are of steel tube built in so as to take the torsion between the spars

There are four ailerons of wood construction They are connected in pairs by a single strut between each pair and are operated through the lower wing An interesting feature of the aileron control is the mounting of an auxiliary airfoil above, and rigidly connected to each lower aileron by two short struts Serving to balance the ailerons for easier control, these airfoils working as they do in comparatively undisturbed air, materially assist the lateral control at low speeds for they add an appreciable amount of surface to the total of the four ailerons, each of which measures 9 ft by 20 in

The landing gear is a Timm development of the rubber-hydraulic type Four short struts extend from the lower fuselage longeron to the ends of the straight axle of heavy heat treated steel tubing The two rear struts contain shock absorbing units built by Otto Timm, which employ both rubber and controlled liquid quite successfully to ease the shock of landing and to check the rebound The two forward struts are rigidly attached to the axle but are hinged to the longeron They are rigidly cross braced with wire. This provides a well braced, sturdy landing gear which is free to move back and up against the action of the absorber units as the airplane meets the jolts incident to ground maneuvers The tail skid is of laminated steel tube, is pivoted and is mounted with wound rubber chord absorber unit

The entire empennage is constructed of chrome molybdenum steel tubing The rudder is unusually large and well balanced The fin is braced to the horizontal stabilizer by two struts The stabilizer is braced to the fuselage by two fixed struts in front and is adjustable through the two rear struts by means of a worm gear drive operated from the cockpit and which is said to function easily even under maximum load The elevators are also balanced for ease of control and are operated by means of wires within the fuseslage to a lever control that extends outside the body near the tail and connects to the flipper horn by means of a rigid steel tube, thus eliminating outside wires in the vicinity of the tail surfaces.

Although complete flight tests have not yet been given this airplane it has shown a maximum speed with full load of 112 m p h and will land at 35 m p h. Having taken off with 2530 lb load after a run of approximately 900 ft there is evidence that the designer's hope of lifting a 7500 lb load will be realized

Although this model was a special job constructed for high altitude work, it will probably be placed in production if Captain Turner is successful in setting a new endurance record At the present time the O W Timm Aircraft Corp is devoting all factory facilities to the quantity production of a small training monoplane

Specifications of the Timm biplane as supplied to

AVIATION by the manufacturer

Length overall	31 ft 9 in
Height overall	11 ft
Airfoil	Clark-Y
Span (both wings)	45 ft
Chord (both wings)	6 ft
Gap	6 ft 9 in
Stagger	3½ in
Area wings, total	510 sq ft
Area of ailerons	54 sq. ft
Area of horizontal stabilizer	28 sq. ft
Area of elevators	30 sq ft
Area of fin	5 sq. ft
Area of rudder	15 sq ft
Power plant	260 hp 9 cylinder Menasco-Salmson
High speed	112 m.p.h
Cruising speed	100 m p.h
Landing speed	35 m.p h

Regarding the National Air Tour

(Continued from page 594)

gers, was equipped with three Wright "Whirlwinds" Hawks' figure of merit was 798 3 and he registered that over 26 legs of the 32 The nose engine on Hawks' plane suffered a broken crankshaft on the flight from Indianapolis to St Louis and although the pilot had to fly 100 mi into St Louis with two engines, he arrived on scheduled time Beginning with the St Louis-Springfield leg Hawks was late for six consecutive legs, due chiefly to the headwinds over that section After leaving San Antonio he flew the remaining legs of the route on scheduled time Hawks' score was 24,390 8 He finished second

Entry Number Three was a Travel Air biplane powered by a 135 hp Fairchild-Caminez engine J. Nelson Kelly was the pilot and he carried a mechanic Kelly also flew 26 of the 32 legs in perfect time He received a new propeller, a prop that had been on the Fairchild-Caminez powered Waco Number 28 at Indianapolis and completed the Tour with it Carbureter trouble caused Kelly to be late starting from the field in Tucson, and, as a result he was late into Yuma He also arrived late into Portland principally because of having to fly approximately 30 mi out of the way in following the valley route via Roseburg on the flight from Medford The remainder of the Tour was made with perfect scores, although he was forced down between St Paul and Wausau, Wis, to replace two blown sparkplugs Kelly's plane, and that flown by Gould Beard introduced the Fairchild-Caminez engine to many sections in the West His total score was 15 780 2 and he finished thirteenth Kelly's figure of merit was 522

Entry Number Four was an Eaglerock, flown by "Benny" Howard and powered by a Menasco-Salmson After scoring two perfect schedules of 318 6 points each over the first three legs, Howard was forced down between Wichita and Tulsa, with engine trouble Because of an inability to secure engine parts quickly enough he dropped out of the contest

Curtis "Robin" Only OX-5 Entry

Entry Number Five, a Curtis "Robin," piloted by "Dan" R Robertson, failed to show up as well as it might have, principally because of an engine that was understood to have considerable hours to its credit before the Tour started The plane is powered by an OX 5, and it was the only OX 5 job in the Tour Robertson flew 19 of the 32 legs on scheduled time His figure of merit was 232 7, and he carried one passenger Number Five was late into San Francisco because of tire trouble on the field at Fresno While attempting to start up the engine preparing to leave San Francisco, the propeller struck Robertson's mechanic on the arm and was broken Because of the delay in replacing the broken prop Robertson flew late into the next three stops One more perfect leg was down, then engine trouble dogged him again He returned to the field in Tacoma, shortly after taking off for Spokane At Sutton, N D, on the leg between Minot and Fargo, Robertson's engine again forced him down After arriving in St Paul Number Five flew the remaining five legs on scheduled time Robertson's score was 5,949 9 and he finished twenty-third

Entry Number Six Dave P Levy, pilot of the Stearman entry, was the only pilot flying the Tour who scored his figure of merit over every leg of the route Levy's perfect score for a leg was 396 9 and there was not a break in his record He was forced down but once, at Thompson Falls, Mont, on the leg between Spokane and Missoula, but managed to get in on time Levy also was the youngest pilot on the Tour, being but 21 years old His Stearman was powered by a "Whirlwind" and he carried one passenger The score on Number Six was 12 700 8 He finished seventeenth because of his low figure of merit

Entry Number Seven This plane, a Buhl "Airster" biplane, was piloted by Alger Graham It was equipped with a "Whirlwind" and Graham flew 26 of the 32 legs on scheduled time Headwinds and the misjudged distance between St Louis and Springfield, caused Graham to be late on practically all of his imperfect legs, although he was late arriving at the airport before the start from Chicago, and was late into Battle Creek for that reason. Graham's figure of merit was 442 9 and he carried two passengers, including Ray Cooper, the Tour Manager Score 13 528 2 Finished sixteenth.

"Airsedan" Flies 29 Perfect Legs

Entry Number Eight Louis G Meister piloted Entry Number Eight a Buhl 'Airsedan' sesquiplane, powered by a "Whirlwind" He flew 29 of the legs on perfect time, maintaining in doing so a required speed of 109 36 m p h Meister's figure of merit, 592 4 was broken between St Louis and Springfield, for reasons stated above, between Ft Worth and Waco because of severe headwinds, and between Waco and San Antonio, when he was forced down at Round Rock, Tex, after a valve adjuster had backed off Meister had one other forced landing, between Tacoma and Spokane, when he landed to replace a blown plug This landing, however, did not prevent him from flying into Spokane on schedule Meister carried a mechanic His score was 17 928 1 and he finished tenth

Entry Number Nine was a "Whirlwind" powered Ryan brougham, piloted by E. W. "Pop" Cleveland. "Pop" flew 21 of the 32 legs on schedule, being afflicted with a wide variety of mishaps. His figure of merit, 292.5, was missed on the first leg. Cleveland made it on the second, missed again on the third and fourth, and made it on the fifth. On the sixth leg, between Tulsa and Ft. Worth, he was forced down when his spinner broke. A landing on a small and rough field resulted in a considerably damaged undercarriage and broken prop. Headwinds caused several other imperfect legs until the Tour arrived in San Diego. Cleveland was late starting from San Diego. Cleveland was late starting from San Diego because of having to await a telephone call. In Los Angeles he broke his tail skid and was late into Fresno. Three perfectly flown legs followed, then starter trouble caused Number Nine to be late into Portland. Five more perfect legs then, in Froid, Mont., the Ryan's brakes locked and caused Cleveland to be late into Minot. The remaining legs were flown on scheduled time. Cleveland carried three passengers. His total score was 8,169.4 and he finished twentieth.

Entry Number Ten: Al Henley piloted Entry Number Ten, another "Whirlwind" Ryan brougham, making 27 of the legs on scheduled time. He was one of the three Tour pilots who managed to get into Springfield, Mo., on schedule. The following day, however, between Wichita and Tulsa, Henley had the misfortune of experiencing two landings caused by engine trouble. His score for that leg, 349.3, was the lowest score he made, his perfect score for a leg being 646.8. Headwinds upset his schedule between Ft. Worth and Waco, and engine trouble on three legs between Yuma and San Francisco, caused the rest. After leaving 'Frisco Henley flew his Ryan over every leg on scheduled time. He carried two passengers. His score was 19,728.9 and he finished seventh.

Fails to Start

Entry Number Eleven: A Challenger, model C-3, biplane, powered by a Fairchild-Caminez engine. Never started.

Entry Number Twelve: Number Twelve was an Eaglerock, Hisso "E" powered, and flown by Cloyd P. Clevenger. Clevenger carried one passenger and flew 26 of the 32 legs on schedule. Headwinds caused practically all of Clevenger's imperfect scores. He flew every one perfectly after leaving Yuma. Clevenger's total score was 11,477.7. He finished eighteenth.

Entry Number Thirteen: Number Thirteen, a Mohawk "Pinto," powered by a Warner "Scarab" engine, could not be made ready in time to start.

Entry Number Fourteen: This entry, a Travel Air biplane, was the only plane in the tour powered by a Ryan-Siemens (9) engine. After making a very nice start, flying six of the first ten legs on perfect schedule, despite the headwinds over that part of the route, George B. Peck, the pilot, became the victim of accessory trouble in El Paso and was 11 days catching up with the remainder of the Tour. Magneto trouble, experienced on the field at Fort Bliss, El Paso, prevented Peck from taking off with the other fliers and flying into his home town, Tucson, Ariz., with them. It was a tough break for the little pilot and all of the airmen were glad to see Peck again when he rejoined the Tour again in Great Falls, Mont. Although after rejoining the Tour Peck flew the remaining nine legs on schedule, his trouble in El Paso proved costly, and he finished twenty-second. His figure of merit was 361.6 and his total score, 6,715.4. Peck carried one passenger over most of the 6,600 mi.

Entry Number Fifteen. This entry, a Fleetwing monoplane, with two "Whirlwinds," was to have been flown by C. C. Runkell, of Detroit, but it could not be made ready in time to start.

Entry Number Sixteen: Vance Breese, who introduced the Ryan M-1 to many parts of the United States in 1926 when he flew Ryan Number 23 in the National Air Tour of that year, again piloted a Ryan, this time a Brougham. Vance carried two passengers, and flew 28 of the 32 legs with perfect scores. Headwinds and the troublous leg between St. Louis and Springfield caused Breese's four imperfect legs. After leaving San Antonio he flew the rest of the route on scheduled time. His figure of merit was 592.4 and his total score, 18,389.3. He finished in ninth place, a position he had held from the start.

"Swallow" Sold in Tulsa

Entry Number Seventeen was a Swallow, powered by a J5ab. This plane started with Jay Sadowsky at the controls, but was sold to Clarence W. Helm, of Elgin, Ill., while the Tour was in Tulsa, after which Merlin V. Aavang became pilot and Helm his one passenger. The plane was flown over the 32 legs with only one being imperfectly flown, that being the aforenamed St. Louis-Springfield jump. The Swallow finished fifteenth, with a total score of 13,604.8 and a figure of merit of 428.5.

Entry Number Eighteen: John Paul Wood, of Wausau, Wis., flew Waco Ten, Number Eighteen, to first place in the Tour, having accumulated a total score of 27,013.4. Wood's figure of merit, 850.4, was the highest figure of merit among all of the competing planes. Wood took the lead on the first leg and held it throughout the long flight. Except for the St. Louis-Springfield leg he flew the entire Tour with perfect scores. The prime importance of a low stick and unstick is seen in Wood's case, his stick being 4 seconds flat and his unstick being 5.1 seconds. The pre-Tour tests on Wood's Waco showed as follows: Gross Weight, 2,600 lb.; Empty Weight, 1,650 lb.; Contest Load, 950 lb.; 75 per cent of the Contest Load, 712 lb.; Maximum Speed, 128.1; 80 per cent of the Maximum Speed, 102.48; and Engine Displacement, 788. Wood won the Tour by a wide margin. He carried Frank Clewers as mechanic, and experienced no trouble with his plane and Wright J5.

Broken Valve Forces Myers Down

Entry Number Nineteen: Number Nineteen was another Waco Ten, this one piloted by Charlie Myers. Myers missed his figure of merit on but two of the 32 legs, being late on the St. Louis-Springfield hop, and being forced down at Dodd Field, near San Antonio, with a broken valve. Fortunately, San Antonio was a two-day stop, and through the sportsmanship of Jack Frost, San Antonio banker and flier, Meyers was able to get a new engine. Although Meyers' score for the Waco-San Antonio leg was reduced from 718.2, his figure of merit, to 12.3 because of his forced landing, he took off on scheduled time from San Antonio, and experienced no more late arrivals. With a total of 22,127.1 he finished fourth. He carried two passengers. His plane had a J5.

Entry Number Twenty: Eddie Stinson, who won the Tour last year, and who has flown the last three Tours, took fifth place this year, with his "Whirlwind" powered Stinson-Detroiter. Like most of the fliers Stinson was late into Springfield, but he managed to annex perfect scores for the rest of the legs, except that between Tulsa and Ft. Worth. Eddie replaced his engine in Tulsa, then had the "new" engine overhauled in San Antonio. He carried four passengers, and his total score was 21,243. Stinson's figure of merit was 673.1.

Entry Number Twenty-One was another Stinson, this one being a Warner engined Stinson Junior, and flown by Randolph G. Page. Page had the only Warner engine in the Tour. He flew 26 of the 32 legs on schedule, his principal delays being caused by headwinds over the early portion of the route. After leaving San Diego Page flew the remaining nineteen legs without any tardy arrivals. With a total score of 22,786.5, he led the closest of the other two Stinson competitors by more than 1,000 points and finished third. His figure merit was 752.8 and he carried two passengers.

Entry Number Twenty-Two: Headwinds over the Ft. Worth-Waco leg and that much mentioned St. Louis-Springfield leg caused the only two imperfect scores suffered by Bruce Braun, pilot of Stinson-Detroiter Number Twenty-Two. Braun, whose plane was powered by a "Whirlwind," had a figure of merit of 630.3. He narrowly missed being late into St. Paul because of a blown sparkplug, which caused him to return to the Fargo airport, shortly after taking off on that leg. With a total of 19,871.3, he trailed Eddie Stinson, and placed sixth. Braun carried two passengers.

Entry Number Twenty-Three: Like the Swallow, Entry Number Twenty-Three, a Lockheed "Vega," was flown over the Tour with two different pilots at the controls. "Bob" Cantwell put the plane through its pre-Tour tests and flew it as far as Los Angeles, but there was compelled to withdraw because of the illness of his wife. Lee Schoenhair flew Number Twenty-Three over the rest of the route. After three legs muffed at the start, Cantwell succeeded in attaining his perfect score of 575.2 over the Springfield-Wichita leg. He was delayed by headwinds between Ft. Worth and Waco, but then scored perfectly until he was relieved in Los Angeles. Schoenhair flew the Lockheed with perfect scores over all of the remaining legs, except two, being delayed by tire trouble on the Fresno field, and again in Battle Creek by his failure to arrive on the Chicago field in time to prepare for his scheduled take-off. The Lockheed was powered by a J5-c, and carried two passengers. Altogether it finished the route with 26 perfect scores. Being one of the two fastest planes in the Tour the Lockheed usually roared into leg terminals ahead of the remaining entries. Schoenhair's total score was 17,595.6. He finished eleventh.

Pears Pilots Fairchild Monoplane

Entry Number Twenty-Four: Richard W. Pears, pilot of the Fairchild monoplane, Number Twenty-Four, flew 29 of the 32 legs with perfect marks, two of his delayed arrivals being due to headwind and the other to the miscalculated distance between St. Louis and Springfield. After leaving San Antonio Pears flew over every leg on schedule. The Fairchild was equipped with a Wright "Whirlwind." Pears carried one mechanic, and over one leg, Tulsa to Ft. Worth, carried an extra burden in the person of AVIATION'S representative. It might be mentioned here that a number of the competing pilots were generous enough to carry surplus weight over portions of the long route whenever they were asked. Shortage of seats in the touring plans made this request necessary at certain times. With a total score of 15,974.5, "Dick" Pears finished twelfth in the Tour.

Entry Number Twenty-Five: Number Twenty-Five was a Bellanca flown by Capt. George W. Haldeman. George missed on the St. Louis-Springfield leg for reasons well known, was held back by headwinds between Ft. Worth and Waco, and was delayed getting into Fargo by damages to his plane while attempting to take off in Minot, but he flew 29 of the legs on scheduled time. While taxiing for a take off in Minot Haldeman's plane struck a bad spot on the field and turned up on its nose. The prop was bent and the under portion of the fuselage broken. Haldeman, however, was delayed only long enough to bring his score from 482.2, his figure of merit, down to 372.4. The Bellanca was powered by a "Whirlwind," and carried, beside the pilot, three passengers. Its total score was 15,080.4, and it finished fourteenth.

"Monocoupe" Makes Good Showing

Entry Number TwentySix: In many ways Entry Number Twenty-Six, a Monocoupe, flown Mrs. Phoebe Fairgrave Omlie, of Memphis, Tenn., gave the most satisfying demonstration of any plane in the Tour. This diminutive enclosed cabin monoplane, powered by a 47 hp. Velie engine, was flown over the entire 6,600 mi., negotiating the highest mountains, soaring through the intense heat, cutting its way through the strongest headwinds, and, despite an accident on the flying field at Marfa, Tex., that kept it separated from the Tour planes for six days, it managed to fly 15 of the 32 legs on scheduled time. Except for the portion between Marfa and San Francisco, Number Twenty-Six was piloted by Mrs. Omlie. Between El Paso and San Francisco she piloted Entry Number Twenty-Nine, another Monocoupe, with a record practically parallel to that of Number Twenty-Six. Jack Atkinson, pilot of Monocoupe Twenty-Nine, gallantly placed his plane at the disposal of Mrs. Omlie, and returned to Marfa from El Pasa to repair the damaged Number Twenty-Six, and fly it back into the Tour. The woman pilot had flown from Marfa to El Paso in the tri-motored Ford piloted by Hawks. Mrs. Omlie ground looped the tiny plane while landing on the Army field in Marfa. The flights around the Tour made by the two Monocoupes were the longest and most difficult flights made by any plane their size in this country. With a total of 5,523, Mrs. Omlie finished last, but that did not prevent her flight from being the most surprising, enlightening and encouraging feature of the 1928 Tour. Mrs. Omlie's figure of merit was 254.

Entry Number Twenty-Seven: Number Twenty-Seven was entered in the Tour as a Curtiss-Wright monoplane, powered by three Anzanis, but the plane never appeared at Ford Airport for the pre-Tour tests.

Entry Number Twenty-Eight: This plane was a Waco Ten, powered with a Fairchild-Caminez, and piloted by M. Gould Beard. Despite the headwinds and a goodly portion of engine trouble, Beard flew the Tour with 20 perfect scores, his figure of merit being 321.6. In Indianapolis, as already related, the prop was taken off Number Twenty-Eight and placed on Number Three. This kept Beard separated from the Tour until it reached Tulsa, consequently greatly lowering his scores over that portion. In Medford, Ore., a connecting link plunged through the engine's crank case, in Spokane Beard returned to the field with a broken cylinder stud, and in Fargo he was two hours late starting because of a broken rocker arm stud. Because of his various troubles Beard, no doubt, became the hardest working pilot on the Tour, and he deserves a lot of credit for finishing twenty-first with a total score of 7,850.6. He carried no passengers.

Entry Number Twenty-Nine: As previously stated, Jack Atkinson flew Entry Number Twenty-Nine, a Monocoupe, powered by a Velie engine. Number Twenty-Nine was flown from El Paso to San Francisco by Mrs. Omlie and accumulated 14 perfect scores over the 32 legs of the Tour route. On the second leg, between Indianapolis and St. Louis, Atkinson was compelled to land at Anderson, Ind., to replenish his fuel supply. Magneto trouble while going from San Diego to Los Angeles brought the plane

down again at Laguna Beach, Calif, but this time it was being flown by Mrs. Omlie Atkinson was late into Corning, Calif, due to waiting on the San Francisco airport for Mrs Omlie, who did not choose to take off in the fog. This caused him to be late on the three legs between Frisco and Portland In Portland an illness caused Atkinson to be late in covering the next four jumps He rejoined the Tour at Great Falls, however, and registered his figure of merit, 367 3, for the five successive legs The Velie engine then dropped a valve over the Wausau-Milwaukee leg, and brought Atkinson down He replaced the engine with a new one, and again rejoined the touring planes in Chicago Neither Atkinson nor Mrs Omlie carried passengers under their contest load, the woman pilot carried Mrs Eddie Stinson from Ft Worth to Marfa, and again from San Diego to Los Angeles, and Atkinson carried AVIATION's representative over two legs of the Tour between St Louis and Wichita

Although one could never get any of the pilots flying the Tour to admit it one of the most remarkable feats of the 1928 Tour was the splendid way in which all of the pilots navigated their planes over the long and trying course Several of the younger men, and, we understand, Mrs Omlie, prior to the Tour, never had a whole lot of experience flying cross-country Despite this handicap, very few cases of being "lost" were reported One or two of the planes were equipped with such modern navigating instruments as earth inductor and aperiodic compasses, although most of them depended solely upon ordinary compasses and Rand-McNally maps Over a large portion of the route, namely, over the desert and mountain country, where such convenience guides as section lines were lacking, maps were virtually useless Several of the pilots reported their compasses affected by what was believed to be a mineral deposit in the mountains of West Texas

The widely varied temperatures encountered on the Tour had little or no effect on the engines, if a majority of the pilots are to be believed Dust, they said, met with on some of the fields caused them more trouble than did the extreme heat

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The "Super-Mailwing"

(*Continued from page 593*)

Streamlining has been applied wherever possible—navigation lights are now set inside the wings and rudder with celluloid covers of proper color, wing wires attach to fittings inside instead of outside the wings, the openings being covered with celluloid windows for inspection this eliminates the usual streamline covers with their added resistance and the necessity of removing them for inspection The exhaust manifold ring is sunken into the streamline engine cowling giving an extremely clean appearance to the engine installation and further reducing head resistance A small gap between the manifold and the fuselage cowling provides adequate and even cooling by venturi action

The under carriage of the new plane is very similar to that of the PA-5, having, however, a slightly wider tread The undercarriage design is such that the pneumatic shock absorber struts are interchangeable among the best known makes and this applies to the wheels and brakes also

As in the Mailwing PA-5 the mail compartment of the Super-Mailwing is in the fuselage between the engine and the pilot's cockpit and centered around the center of gravity of the plane so that whether a heavy or light load is carried in this compartment the center of gravity is not moved more than one or two inches The balance of the plane and its flying characteristics are, therefore, little affected by taking on or leaving off large pouches at various stops along an airmail route

The Super-Mailwing is fully equipped for night and blind flying with compass, turn and bank indicator, air speed indicator, altimeter, tachometer, oil pressure, oil temperature and fuel gauges; navigation lights, landing lights battery, and indirectly lighted instrument board with rheostats to dim or brighten the instrument board lights on dark or moonlight nights All wiring is sheathed in metal cables and all metal parts of the plane, including

View of one of the wing brace wire fittings and the transparent inspection windows used on the Pitcairn "Super-Mailwing."

wing fittings, are electrically bonded to eliminate the possibility of an electrical discharge due to lightning, and to provide shielding in case radio is used Space is provided for the installation of radio beacon equipment

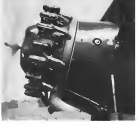
Orders for fifteen Super Mailwings, totalling over $170 000 were received by Pitcairn Aviation, Inc, before the first plane was completed Among those ordering planes are the Department of Commerce, National Air Transport, Colonial Air Transport, Colonial Western Airways and Canadian Colonial Airways The plane will also be used on the New York-Atlanta and Atlanta-Miami airmail services of Pitcairn Aviation, Inc

The general details and specifications of the Pitcairn Super-Mailwing PA-6 are as follows

Over-all wing span, upper	33 ft
Over-all wing span, lower	30 ft
Over-all length	22 ft 10½ in
Over-all height (standing on ground)	9 ft 3 in
Wing chord, upper	54 in
Wing chord, lower	48 in
Mean aspect ratio	7 42
Wing area	262 sq ft
Dihedral, upper wing	1
Dihedral, lower wing	4

Gap at fuselage	62 in
Stagger	22 in 42½%
Area of ailerons	21 sq. ft
Area of stabilizer	15 5 sq ft.
Area of elevator	14 5 sq ft
Area of fin	4 2 sq ft
Area of rudder.	6 4 sq ft
Weight, empty	1840 lb.
Total weight	3000 lb.
Wing load	11 5 lb/sq. ft.
Power loading (220 hp)	13 6 lb /hp
Gasoline capacity	76 gal.

The first plane, which performed entirely satisfactorily without alterations is being very completely and thoroughly tested on the New York-Atlanta-Miami airway in both day and night flying without carrying mail



A view of the engine cowling of the Pitcairn "Super-Mailwing," showing the sunken exhaust manifold.

The Travel Air 6000

(Continued from page 592)

wood and covered with fabric, the rear one on each side being adjustable

The welded steel tube fuselage is braced in the forward end by tubes and in the rear by swaged tie rods. Corners are rounded with plywood and the entire structure is covered with Grade A Flightex fabric and finished in Travel Air blue. Two doors in the right side of the fuselage give access to the cabin. The one at the rear opens into the roomy passengers compartment and the one at the forward end opens into the pilots' compartment. Provision has been made for four passengers and two pilots seated side by side. Comfortable wicker chairs and ample space for storage of baggage are provided for passengers. A triplex windshield affords excellent visibility for the pilots and all other windows are of plate glass and may be rolled up or down. The cabin is finished in blue velour and all wood and metal parts are inoiled. A dome light in the passengers' cabin and heaters in both passengers' and pilots' compartments are furnished. All instruments required by the Department

of Commerce are installed and adequately illuminated. The night flying equipment is complete and includes a full set of navigation and landing lights. Dual controls are provided for the pilots who sit side by side and wheel brakes are operated by auxiliary pedals. All vital points in the control system are accessible by zippers in the fabric covering.

The power plant is readily accessible by removing the cowling. The engine mounting is detachable and is made of welded steel tubing. A manifold ring developed by the Travel Air Co., comprises the exhaust system. Two

Rear quarter view of the Travel Air 6000, designed for general transport service.

aluminum fuel tanks, each having a capacity of 38 gallons are built into the wing. A Pioneer gasoline strainer is provided and can be drained from the pilots' compartment. All fuel lines are ½ in copper tubing. The engine is fitted with an Eclipse hand inertia starter and a Standard Steel propeller

Landing gear is of the divided axle type with a 9 ft tread and 30 x 5 Bendix wheels with brakes. Travel Air oleo shock absorbers are used as compression members. The tail skid is of the conventional non-steerable type employing rubber discs in compression

The specifications furnished by the manufacturer are as follows

Length overall	30 ft 10½ in
Height overall	8 ft 8½ in
Airfoil section	Gottingen 398
Wing span	48 ft 7 in
Chord	78 in.
Wing area	282 sq ft
Area of ailerons	30 4 sq ft.
Area of stabilizer	28 6 sq ft
Area of elevators	18 0 sq ft
Area of fin	6 3 sq ft
Area of rudder	11 7 sq ft
Weight empty	2375 lb
Pay load	944 lb
Disposable load	1625 lb
Gross weight loaded	4000 lb
Power plant Wright Whirlwind	200 hp at 1800 r p m
Wing loading (200 hp)	14 2 lb per sq ft
Power loading (200 hp)	18 2 lb per sq ft
High speed with full load at sea level	128 m p h
Cruising speed (at 1620 r p m)	107 m p h
Landing speed	50 m p h
Take off run (Fully loaded no wind)	720 ft
Landing run (No wind, with brakes)	300 ft
Climb at sea level	700 ft per min
Climb to 5000 ft	12 min
Climb to 10,000 ft	32 min
Service ceiling	12 000 ft
Absolute ceiling	15 000 ft
Gasoline consumption at cruising speed	12 gal per hr
Gasoline capacity	79 gal
Range at cruising speed	650 mi
Endurance at cruising speed	6½ hr

Spot Welding of Aluminum and Its Alloys

(*Continued from page 591*)

oxide coating, which would prevent metal-to-metal contact. All aluminum and aluminum alloy sheet is covered by an oxide film. With 2S and 3S metal, the film is only of very slight extent and it has very little influence on the welding condition. But the fairly heavy oxide film on the heat-treated alloys 17S, 25S and 51S calls for special treatment. The coating has a very high electrical resistance and where voltages high enough to break it down are used, there usually results such a rush of current when the coating breaks down, that the metal being welded quickly over-heats, causing it to melt. Blow-holes are thus formed through the material before the current can be shut off. When the oxide film does not cause blowing, the welds have oxide inclusions which make a weak, brittle weld. It has been found, too, that thin films of oil or paint, either wet or dry, between the aluminum sheets have practically the same effect upon the spot welding conditions as does the oxide film. It is possible to spot weld aluminum through such films, but heavy mechanical pressure will be required in order to obtain good contact between the surfaces.

In general, better results are obtained when the surface of the sheet to be spot welded is clean. Dirty metal may be cleaned by abrasion or by dipping in caustic, followed by a nitric acid dip to neutralize the caustic adhering to the surface of the metal. If the latter method is used, reasonable care must be exercised in handling the caustic and acid. When strong caustic and concentrated acid are brought together they react with almost explosive violence.

Since spot welding is similar to riveting, efficiencies for the one may be expressed in the same terms as have been used for the other. For rivets, the practice is to express the efficiency as the ratio of the strength of one in. of width of joint, to the strength of one in. of width of the continuous metal.

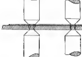


Fig. 4. Drawing showing the heat distribution in two electrode combinations. See text for letter designations.

Considerable variations in the value, for the strength of spot welded joints, were encountered when tensile tests were made on them. Specimens one in. in width were tested. All the values are given in terms of this type of specimen. Fifty thousandths inch 2SO flat sheet, an annealed material, was arbitrarily selected for use in this work of determining the efficiency of spot welded joints. Joints were prepared by fastening two strips together end to end, using one, two, three and four spots. This caused

some crowding of the spots when the large numbers were put on the sheets, which may have been responsible in some way for the erratic results obtained. That is, the distance between the spots may have had an effect upon their respective strengths.

In the case of single-spot joints, to give a typical example, some strips of one in. wide and 0.050 in. thick 2SO flat sheet were welded with one spot, tested, and found to have an average strength of from 250 to 260 lb. If this strength is referred to the strength of a strip of the original metal one in. wide, to express a per cent efficiency, about 38 per cent. is obtained for the efficiency of a single spot. The tensile strength of the metal used was 13,700 pounds per sq. in. Relatively, little variation was found in the strength of different joints of this type, the lowest being 35 per cent and the highest 40 per cent.

In the case of two-spot joints, a range between 396 and 454 lb. was found for the strength of the sheet. The average value was 420 lb. and the average efficiency 63 per cent. In the case of three-spot joints, a minimum of 506 lb., a maximum of 598 lb., an average of 561 lb. and an average efficiency of 84 per cent. were the results obtained. The spots were placed at the vertices of a triangle with one side parallel to the end of the strip. As explained before, a strip one in. wide was the maximum width which could be tested. Consequently, when a joint formed with four spots was tested, no value could be obtained for its strength because the sheet failed. In other words, the joint was as strong, or stronger, than the original sheet.

These results were found to be fairly typical of what could be expected of the welds. The strength of the joint, as in riveting, will depend upon the number of spots. In places where the question of fastening the sheet is the important point, and no great force must be resisted by the joint, a relatively small number of spots would prove sufficient. For other requirements, the number could be increased, the limit being four per in. of the joint, beyond which no further advantage in strength would be desirable. Of course, this refers only to spots in 2SO sheet.

Fig. 3A. Spot welds made in 0.064 in. 3SO sheet, showing the manner in which good welds should fail.

The metal in the spot weld will be in the nature of a chill casting and, when properly made, is perfectly sound. A micrograph of an etched section of a spot weld in 2SO sheet is shown in Fig. 5A. The area, roughly elliptical in shape and bounded by radial crystals, has been completely melted so that metal from the two sheets has run together and has formed a continuous union between them. The structure of the metal in the elliptical area is typical of that of a chilled casting. The light areas on

either side of the photograph result from contact with the electrodes during welding Fig 6 is a longitudinal section of a spot weld through two pieces of 51SW sheet from which the oxide film was removed previous to welding

Three different structures can be distinguished as follows.

(1) The central portion where the metal in the two sheets has been fused together

(2) The original structure of the sheet

(3) Four areas, which have been molten on the outside of the sheets where the electrodes made contacts. The fused central portion is homogeneous and has no holes indicating a good joint.

Fig 7 is a longitudinal section of a spot weld made on two pieces of 51SW sheet, without removing the oxide film. Three different structures similar to those shown in Fig 6 can be distinguished There is a very sharp line of demarcation between the fused metal in the weld and the original sheet This condition, which is apparently due to the oxide film is undesirable as it tends to weaken the joint

It has been found that aluminum, or an aluminum alloy of one composition, say 2S or 3S can be spot welded to an alloy of a different composition such as 17S 25S or 51S It has also been found that wrought sheet may be welded to aluminum castings Strips cut from 2S 3S 17S, 25S and 51S sheet have been spot welded to plates cast from the various alloys The 2S and 3S sheet can be spot welded to 15 per cent silicon castings with remarkable ease.

The range of thickness that can be spot welded varies with the capacity of the machine A 20 KW machine will spot weld two sheets of commercially pure aluminum each 0.064 in. thick. Due to the lower conductivity of alloys slightly greater thicknesses of alloys can be spotted with the same machine. Three or four thicknesses may be spotted at one time Where two items of unequal thickness are to be joined the total thickness of the joint may be somewhat greater than when the two pieces are of equal thickness.

Fig 5 Cross section view of a spot weld in two sheets of aluminum of unequal thickness The black spots are due to areas which were partially fused during welding

The heat conditions in this case may be improved by using, next to the thin metal, an electrode a little larger in diameter than the one next to the thick metal In Fig 4, this condition is shown diagrammatically at A

Under proper circumstances, the current flow will fan out at each side as shown by the radial lines The dotted lines indicate the portion of the metal heated to the welding temperature, the most intense heat being in the narrow area between the dotted lines. This constriction should center in the joint between the two pieces being welded If both of the electrodes used in welding metals of different thickness are alike, the heat concentration is within the thicker one of the pieces, as in B, Fig 4, instead of in the joint which in some cases will produce poor welds by overheating the thicker section before the thin one is hot enough to weld Such a spot through two pieces of 3S metal is shown in Fig 5

It has been found that the spot welding characteristics of aluminum sheet are independent of its temper and that the temper of the sheet surrounding the weld is not materially affected by the heat generated in the process of spot welding A series of Brinell impressions made on a number of spot welded joints of 0.064 in thick 51SW sheet at intervals of ⅛, ¼, ½, 1 and 2 in from the edge of the spot gave the following results

Distance from edge of spot	⅛ in	¼ in.	½ in	1 in	2 in
Brinell Number	55	60	65	65	65

For normal 51SW, the Brenell numbers run from 55 to 70

The stronger alloys, which includes 17S, 25S and 51S, are not materially different from pure aluminum in their behavior during welding. However, in considering the spot welding of the strong aluminum alloys, it should be borne in mind that, in the act of spot welding, a portion of the metal at the point of contact melts and solidifies This area, as already pointed out, has the structure of a casting, and the joint has mechanical characteristics such as could be expected from a cast rivet The 2S and 3S in the cast form are relatively ductile A spot weld in 2S or 3S, therefore, would be quite tough

The strong aluminum alloys, on the other hand, in their cast condition have quite a low elongation, and consequently, a strong alloy spot welded joint cannot be considered very tough In other words, it should not be used in places of high stress where the joint is subjected to considerable vibration.

A number of strips five in long and one in wide, cut from 17ST and 51SW sheet 0.064 in thick, were welded together in pairs to produce specimens 9 x 1 in, having

Fig 54 Micrograph of section of two sheets of aluminum spot welded together.

either two or three spot welds in the one in overlap The tension of these specimens was tested, the breaking load in lb. being detrmined The average breaking load for 17ST, when joined by means of two spot welds, was found to be 880 lb The average breaking load for three

spots was 1,350 lb The average diameter of the spots was ¼ in The failure in every case was due to the spots shearing The average breaking load for the 51SW specimens, joined by means of two spots, was 775 lb.

When the 51SW strips were joined by means of three spots, the average breaking load was 1,250 lb In this case the strips failed, the fracture occurring through the

Fig 6 Longitudinal section of spot weld through two pieces of 51SW sheet from which the oxide film was removed previous to welding.

welds The average diameter of the spot welds in the 51SW was about 3/16 in. The average strength of the spot welds in the 17ST strips was about 10,000 lb per sq in of weld The estimated value for the 17S in the east condition is 18,000 lb. per sq in The average strength of the spot welds in the 51SW strips was 14,000 lb per sq. in. This compares with an estimated value of 13,000 lb per sq in for 51S in the cast condition.

The results of these tests would seem to limit, for the present at least, the use of spot-welded joints in duralumin to any extent for certain purposes, such as in the construction of aircraft, particularly on stressed parts Spot welding of duralumin, however, may have possibilities in place of riveting on cowling and other parts not subjected to severe stresses The spots could be placed close together and heat treatment could be applied, subsequent to welding, for the purpose of retarding corrosion and improving the strength of the joint

Figs 8, 9, 10 and 11 illustrate a few definite cases where spot welding may be substituted for riveting Fig 9 shows an aluminum pan with the handle spot welded on. Four of these pans with the handles spot welded, and four with the handles riveted, were broken in a comparative test. The loads were applied so as to duplicate, as nearly as possible, the conditions that would exist if the pans were filled with some substance, and were picked up by the handles. The handles failed under the following loads

Comparative Strengths of Riveted and Spot Welded Handles

Style of Fastening	*Load required to break*	*Remarks*
Two rivets	354 lb	Clip failed
Two rivets	510 lb	Rivets sheared
Two rivets	534 lb	One rivet sheared, one torn out
Two rivets	549 lb	Both rivets torn out
Average	487 lb	
Spot Welded—two spots	420 lb	Both spots torn out
Spot Welded—two spots	383 lb	Both spots torn out
Spot Welded—two spots	445 lb	Both spots torn out
Spot Welded—two spots	503 lb	Both spots torn out
Average	437 lb	

The average difference in strength of the two kinds of joints is not large enough to condemn spot welding, especially when it is considered that the strength of either joint is greater than would be needed for the use to which the pan would be put However, it shows that spot welding does not yield to riveting by any broad margin when the question of mechanical strength is considered

Fig 11 shows an aluminum article that is assembled by spot welding Over 100,000 of these bands have been spot welded during the past few months These bands were formerly riveted, the rate being 210 bands per day, at a cost of $54.72 per 1,000 pieces At the present time 700 bands per day are being welded at a cost of $34.58 per 1,000 pieces This shows a very substantial increase in production as well as decrease in cost There are many articles which could be manufactured from aluminum on a practical scale by means of spot welding These include filing cabinets, radio shields, metal furniture, various sorts of containers that need not be water tight, cooking utensils, et cetera

A Common Practice

Spot welding of steel is very common practice among manufacturers of sheet metal objects A saving is usually effected in cases where it is possible to apply spot welding in lieu of other forms of welding or riveting Where it takes the place of riveting, the economy appears in eliminating the cost of the rivets themselves, and in time saved in the process Spot welding is much faster than riveting, since there is a total absence of drilling, alignment of holes and the upsetting of the rivets

Spot welding accomplishes in one operation the same end for which riveting requires three and sometimes four; namely, piercing, counter-sinking and inserting the rivets

The spot welded joint is virtually as strong as a riveted joint It contains no crevices or corners difficult to clean, nor can it become loose after a period of service. This last is an important item Aluminum rivets have a tend-

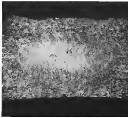


Fig 7 Longitudinal section of spot weld made on two pieces of 51SW sheet without removing the oxide film

ency to stretch and allow some "play" to develop between the parts joined The spot weld, even if it does stretch, is integral with the two parts, and cannot possibly develop any play There are many cases where spot welding may be substituted for riveting or autogenous welding,

with a decrease in cost of making the joint and improvement in the quality of the finished work

Aluminum may be spot welded by essentially the same procedure that is common for other metals. However, the welding of aluminum is a little more difficult, and requires some special precautions. Success in the resistance spot welding of sheet aluminum seems to depend upon the use of a high current for a short period of time. The current and pressure must be properly balanced. More current and greater pressure are required on heavy gauges. If the stock is dirty or corroded a greater amount of pressure is necessary. When holes are burned in the metal or an excessive amount of sparks fly from the weld it is a sign of too much heat and not enough pressure.

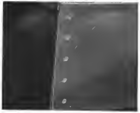


Fig. 8. A view of a spot-welded joint

It is very important that the tips of the electrodes be kept to the proper size and shape, if the best results are to be obtained. The electrode tips must be kept clean and free from deposited metal. The electrodes and tips should be cooled by circulating water through them. The various parts to be welded should be clamped together in such a manner that good contacts are assured in making the welds. This is essential in all electric spot welding.

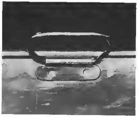


Fig. 9. One of the most common uses of spot welding

If the material to be welded is not firmly held together before the current goes on, it will arc at the welding points and a hole will be burned through the material.

The operator should be sure that welds are holding before turning out much work. If an occasional weld does not hold, it is probably due to dirty or corroded material. The best results can be obtained when the stock is clean and free from oxide; the cleaner and better the stock, the easier it is to weld.

Automatic welders should be used, so that the time during which the current flows can be closely regulated. Attempts to increase speed on hand or foot operated spot welders have frequently resulted in poor welds, owing to the personal equation varying the length of time in making the weld. In addition, the speed on manually operated spot welders, where there is large production, has always been accompanied by fatigue. The automatic air or motor, operated welder insures uniformity in heat, pressure and time. As a result, uniformity in welds and an increase in production are insured.

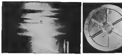


Fig. 10. A side and end view of an aluminum can, which has had a "stiffener" welded to the bottom.

Spot welding produces a strong, rigid joint, which has three distinct characteristics:

(1) There is no movement between parts, which sometimes occurs in riveted parts when the rivets work loose from vibration.

(2) There is no buckling, which is often produced in forcing an alignment of rivet holes in assembly.

(3) The surface is left free of projecting rivets, or the seams produced by the other forms of welding, and is ready to take the paint or other finish without resurfacing after welding. Moreover, when relatively thin metal is used, three or four thicknesses of material may be spot welded together.

Fig. 11. A view of a typical spot-welded joint.

Recent experimental work has demonstrated the practicability of electrically seam welding aluminum. This may be considered merely an extension of spot welding, and the same technical conditions apply for both. However, with the present dearth of exact information, it is not possible to make definite statements or recommendations concerning the electric resistance of seam welding of aluminum and the aluminum alloys.

SIDE SLIPS

By Robert R Osborn

Mr R L R, of Paterson, N J, sends in a clipping from a New York paper of an article describing a special ship which will be entered in the race to the Pacific Coast Part of the description says "Block-tested recently at Roosevelt Field, it is said that the motor registered a speed of 230 miles an hour" Mr R L R inquires, in the note accompanying the clipping, if this isn't a speed record for engine block testing stands. We haven't been able to consult the N A A for official speed testing stand records but can state that this speed has been exceeded unofficially We were witnessing a motor block test a few years ago when something or other in the motor failed to operate as expected and we are sure the test stand was making more than 230 m p h when it went through the shed roof

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There is another interesting clipping from Mr H N T. of Philadelphia, whose initials should be easily recognized by all who know anything about aviation and air races in Philadelphia Mr H. N T's letter says, "Please find enclosed clipping from the August 7th issue of the Evening Bulletin. This would appear to be a matter for the attention of your Society for the Education of Newspaper Artists If, as the picture indicates, the bomber is starting a loop at about 500 ft from the ground, the use of the anti-craft gun in such a case would seem unnecessary except in an attempt to make "assurance doubly sure."

The picture shows a bombing plane flying upside down over a group of National Guardsmen operating an anti-craft gun It is evidently one of those composite pictures, which have been named "composographs" by the New York tabloids So, we herewith add a "composographers" section to the aeronautical education society. As soon as we can find a member to join the society, we'll investigate some of these complaints.

* * *

A recent issue of the "Domestic Air News" of the Department of Commerce has some interesting interpretations o nthe laws pertaining to parachute jumping, from which we quote "Parachute jumping, except in emergencies for the purpose of saving life, is placed in the category of acrobatic flying" As far as our reaction to parachute jumping is concerned, any but emergency jumps are for the purpose of waiving life

* * *

A further interpretation of the rules by the Department states "The jump must be made and parachute opened above fifteen hundred feet" No penalty for breaking this ordinance is mentioned and we suppose this is because the penalty is self-applying if the jump and opening is made at a much lower altitude

* * *

We see by the newspapers that another airplane has been flown from the deck of a boat for the first time in history There has been a fairly good crop of these first flights in history from a ship this year, this being about the fifth since Chamberlain "proved it could be done."

* * *

A photograph of Colonel Lindbergh was broadcast by radio from an airplane in a recent test of a new invention This was an excellent photograph to select for this first test as there must be millions of people who have been wondering what the young chap looks like.

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